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ABSTRACT

This book for sheltered workshop administrators outlines and explains the essential elements of an accurate work bid. Part 1 discusses issues that need to be resolved prior to calculating costs for a potential job. Part 2 describes the factors necessary for determining accurate bids, including direct costs (job setup, direct labor, direct materials, freight, direct machinery, and equipment); indirect costs (indirect labor, indirect materials, supervision, administration, indirect equipment); overhead (general administration, building occupancy); profit; and rehabilitation costs. Part 3 is a completed example of a contract bid. The publication also provides a procedural format for establishing bids (including examples and sample forms), and defines the terms and concepts necessary for the development of an accurate bid. (KC)

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CONTRACT BIDDING
FOR
REHABILITATION FACILITIES

BY

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Introduction

Subcontract work can serve a number of important purposes for sheltered workshop programs. It may be: (1) an aid in the evaluation process, (2) a key part of the work adjustment program, or (3) a source of income and employment for many handicapped individuals. Yet, many workshops are unable to obtain sufficient work to keep their handicapped workers employed. This problem, if left unresolved, can contribute to frequent layoffs, lowered number of work slots for rehabilitating clients/employees, financial difficulties for the workshop, etc. Why are most workshops suffering from a lack of work while a few have more than they can handle? One very important reason for the lack of work in the workshop is due to their failure to accurately prepare the bid quotation submitted on the proposed jobs. A bid is a "quotation, preferably submitted in writing, of the price for which a workshop will perform a specific job or service" (Titus, 1976a, p. 89). This price is known as the bid price.

An inaccurately prepared bid is one which is either overbid or underbid. Submitting a bid whose prices are higher than what they actually should be (overbidding) may result in the workshop (1) not obtaining the contract, (2) not being offered the opportunity to submit future bids as they are assumed to be high-priced or unknowledgable about pricing, or (3) developing financial problems and facing employee layoffs due to an insufficient quantity of work. Submitting a bid whose prices are lower than what they actually should be (underbidding) may result in (1) reduced net profit from the contracted job, or (2) a net loss from the contracted job (workshop is then subsidizing the business). As a result of reduced net profit or net loss, the workshop may develop financial problems which necessitate employee layoffs.

The purpose of this publication is to outline and explain the essential elements of an accurate bid. The specific objectives are:

Part I: Discuss issues that need to be resolved prior to calculating costs for any potential job, and

Part II: Describe the factors necessary for determining accurate bids.

This publication will also provide a procedural format for establishing bids (including examples and sample forms), and define the terms and concepts necessary for the development of an accurate bid. A completed example has been included so that the reader can obtain a better grasp of the narrative.

The accurate preparation of bids for potential contract jobs will greatly enhance the workshop's business image within the community. It will contribute to the financial and programmatic stability of the workshop while simultaneously providing an ample amount of work for its handicapped clientele.

Alan Gilbertson, M.S.
November, 1980

PART I: DETERMINING JOB SPECIFICATIONS AND PRODUCTION METHOD

An important component of price estimating which is often overlooked by rehabilitation workshops pertains to the determination of job specifications and production method for the proposed job. Bidding on a job whose details and specifications are unclear or unknown to the person(s) responsible for pricing can result in a costly error for the workshop. For example, consider the following situation: a local business concern has contacted the workshop concerning a "crucial, rush job" they need to have completed within two days. They do not have the manpower presently available in order to complete the job. Since the job is being done for another business (who is located in another state), a sample of the completed work is unavailable with the local business. The short time frame for completing the work does not allow for a sample to be mailed. The local business has described what the job entails to the workshop. Based on the information, the workshop decides that they can do the job. Thus, they give a firm bid quote to the local business. Later, after the job had been delivered to the workshop, it was determined that the description was accurate for the job; however, the times involved in performing the tasks were significantly in error. Since the workshop was the one who had determined the times for the job, the extra time required to do the job resulted in a net loss for the job.

The failure to properly determine the specifications of the job and the production methods available for the job can result in an inaccurate bid being submitted to the business concern. To avoid this, the workshop should: (1) insist on written specifications from the business, (2) determine if the job can be completed by the workshop, (3) determine the best method capable of being completed by the workshop, and (4) maintain accurate files on all jobs for future reference.

Whenever possible, obtain written specifications for the proposed job. Sometimes this is impossible, due to the urgency of the job. Then, the workshop will be required to obtain the information by telephone or with personal contact with someone within the business concern. Examine the job specifications to determine what is to be done, materials to be used, characteristics of the materials, quality control specifications, production deadlines, jigs, fixtures, machinery or equipment needs, and job skills required (Titus, 1976). The more detailed the specifications of the job, the easier it will be to determine if the job can be completed by the workshop.

Even though work may be desperately needed, the workshop will find that that it will not be able to accept every job. The following factors should be considered in deciding whether or not to accept a job: skill level requirements of both clients and staff, supervision required, production capacity of the workshop, material requirements - whether furnished by the workshop or the contractor,

storage and working space requirements, transportation and shipping requirements, machinery requirements, quality control requirements, and duration of the contract - whether long or short run (Dolnick, 1963). The workshop must determine as quickly as possible if it can do the job. If it can't, the contractor should be notified so they can look to other sources for having their work completed. Courtesy and communication with the contractor may result in future job possibilities.

Once the workshop has determined that it can complete the job, it should then decide upon a method which is capable of being completed by the clients assigned to the job. Workshop personnel must determine the most efficient method of doing the work which their clients are capable of completing. Then, when they calculate their costs, they will reduce the risk of accepting work providing little or no profit. Remember, the best method of completing the job is not necessarily the one which is completed in the fewest operations, but rather the one which can most efficiently be completed by the clients assigned to the job.

Specific factors that should be considered when determining the method of completing the job include the following: (1) Will the individuals who performed the work for the time study be the ones assigned to complete the job tasks, or will others assume that role? If so, a different method of operation may become necessary. While the time study method may be the proper method for the job, if clients are unable to undertake the method, then direct labor costs may become more or less than anticipated. The method chosen for the job must be compatible with the skills of the clients that will be assigned to the job. (2) Are there unnecessary steps which could be eliminated or absorbed into other operational tasks? Direct labor costs may be reduced by doing this. (3) Is there a piece of machinery or equipment which can simplify the completion of the work, and which is practical and feasible for the workshop to purchase, rent, or borrow? (4) Are there better environmental conditions which can or should be met for the duration of the job? (5) Can jigs and toolings be designed or made available to complete one or more steps of the job? (6) Can a better layout of the proposed job be designed to reduce unit costs and get out more production in equal or less time? The above are some of the fundamental questions which should be considered when determining the method for the job. Everyone in the facility will have ideas on which method is the most efficient and practical. Confer with them. It may save the workshop money! Also, when employees have been consulted about the method of the job which should be used by the workshop, they may be more apt to accept the method chosen, whether their method or someone else's.

The setup and maintenance of an accurate and comprehensive record system for all workshop jobs can be very useful in determining costs on future jobs. It can also eliminate potential problems which might arise from present and past jobs (e.g., explaining to a customer why the job was returned late, why the business was billed more than initially anticipated). A complete record system should include the following information for each job: time study data, outside bids and quotations, methods and equipment descriptions, costs and wages, manpower for completing the work, materials and supplies used, dates jobs received and shipped, and diagrams and written specifications of the job. The workshop will want to include any other information it feels pertinent. The objective is to develop and maintain a record system which can provide the workshop with adequate information for making accurate decisions and bids on future jobs, and/or which can justify present and past job costs to prospective contractors.

The workshop which obtains written specifications, determines whether or not it can do the work prior to submitting a bid, determines an efficient method of production, compatible with client abilities, and maintains accurate files on all jobs, will have established a solid framework for calculating accurate bids on future jobs. What are the benefits? Fewer employee layoffs, adequate work slots for clients and employees, a better financial picture for the workshop, and raises for staff and employees, to name a few.

FACTORS FOR DETERMINING BID PRICES

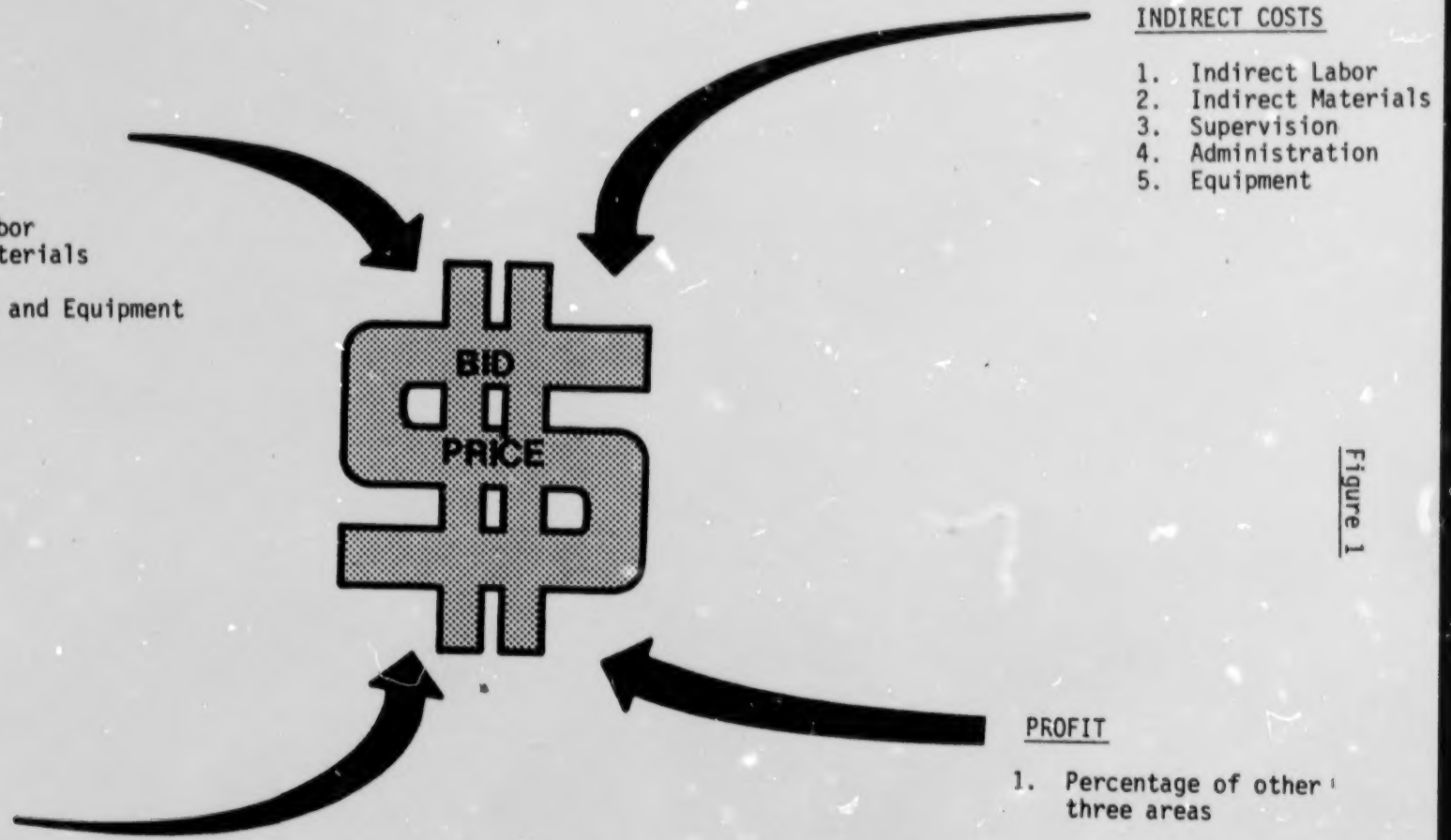

Figure 1

PART II: FACTORS IN DETERMINING BID PRICES

Once a clear understanding of the overall job is obtained, it next becomes important to consider the factors that actually determine bid prices. There are four areas (or factors), and each has a number of sub-components:

1. DIRECT COSTS
2. INDIRECT COSTS
3. OVERHEAD
4. PROFIT

Note Figure 1 on page 4.

1. DIRECT COSTS

The first major factor necessary for determining costs is that of ascertaining direct costs. These are "costs which can be traced directly to a specific piece part, subassembly, or product and should include such items as the costs of tools and/or equipment specifically used for a particular product, the cost of materials and supplies from which the product is made and the cost of labor used to manufacture the product" (U.S. Department of Labor, 1978, p. 9). Elements which make up direct costs include: job setup, direct labor, direct materials and supplies, freight, and machinery and equipment. Each element must be considered when determining direct costs.

Job Setup

The first element of direct costs is that of job setup. This is "the time/cost necessary to prepare a piece of equipment or a work place prior to actually performing the operation(s) and may be required more than once during the total performance of a project" (U.S. Department of Labor, 1978, p. 11). Setup can be as simple as moving a few tables and chairs into configuration suitable for the work, or as complex as installing an entire assembly line requiring electrical

work, compressed air, and hydraulics. The cost of setup work must be allowed for when bidding a job. Setups are often modified after a job starts, and this projected cost should also be considered.

The rationale for attempting to set up the best possible method for a proposed contract job can be summarized in two points. First, before any job can be time studied, a method of performing the work tasks must be determined. The earlier section on "Determining Job Specifications and Production Method" discussed this issue, but not in detail. The reader should consult other books on job specification for a more in-depth discussion of the area. Unless the workshop desires to time study several methods for completing the job tasks, it is best that one method, capable of being accomplished by the workshop employees, be decided upon prior to the time study. Direct labor costs are then calculated, based on the job setup selected by the workshop. Any subsequent change in job setup has the effect of modifying the initial time study. If such modifications are made after the bid has been accepted by the customer, then the change in time study results becomes very relevant. The modification(s) may be necessary from the perspective of the customer; subsequently, additional labor costs attributed to the modification(s) of the job setup should be accepted by the customer. If unacceptable, the workshop will have to assume the increased labor costs for the job. This will reduce any profit derived from the job. Therefore, it is pertinent that the workshop determine the best job setup before submitting a bid to the customer.

Secondly, machinery and equipment needs for a specific job are dependent on the job setup chosen by the workshop. Likewise, the job setup selected may be contingent upon the machinery and equipment available to the workshop. It is very important that the workshop determine a job setup which is compatible with the physical layout of the plant and with existing machinery and equipment within the plant. This should generate the lowest cost pertaining to setting up machinery and equipment for all contract jobs. When existing machinery and equipment is unavailable in a workshop (for a future contract), the workshop will have to procure them. The leasing or purchasing of machinery and/or equipment for a specific contract job is discussed later in this publication; however, it is necessary to discuss job setup as it pertains to this newly acquired machinery and equipment. Setting up new equipment such as hydraulic or air lines, and conveyor belt lines require considerable time and money. Such costs may be included in the costs of job setup. Anytime machinery and equipment must be transported, installed, or serviced for a future job, the costs should be included in job setup.

Estimating job setup costs is a frequent occurence in workshops. This is usually due to equipment and machinery, which is intended for the future contract job, being utilized on other current contracts. When this occurs, the workshop cannot actually place all machinery and equipment into a configuration which is conducive to the job setup desired for the future contract. Here, the workshop will be required to precisely think through each step in the processing of the contract to develop exact job setup costs.

There are eight steps for developing accurate job setup costs. They are:

1. Determining job specifications (Part I, page 1). Obtain written specifications and actual samples, if possible. If the job is fully understood it can make the next step much easier.

2. Decide on a production method. Without a method, the workshop will not be able to determine how the job is to be set up. Factors to consider include:

   a) number of workers required for the job (information may be obtained from a time study of the job tasks, file records on past jobs, the contractor).

   b) amount of floor space needed.

   c) any cleanliness or climate requirements.

   d) types of equipment required.

   e) equipment that will need to be purchased.

   f) equipment that will have to be relocated and subsequent freight or moving expenses.

   g) any electrical wiring of equipment, etc.

   h) the addition of hydraulic or compressed air lines.

   i) plumbing (water) for equipment, etc.

   j) the work flow process for the job.

   Suggestions for the above factors can be obtained from a variety of sources: the company supplying the work, staff within the workshop, industrial salesmen calling on the workshop, or an industrial consultant. Once the method is determined, make a list of all the special requirements (electrical work, jigs or tooling, staff time, etc.). Observe Figure 2A on page 9.

3. Determine individual costs. From the above list (2.), obtain bids and estimates for the setup work and supplies that will be required. Supplies, as used here, represent materials which are used for setting up the job, and does not pertain to those materials which are necessary for completing the job itself. Examples include: electrical wiring materials, air lines, and plumbing materials. Setup work refers to labor costs associated with setting up the job. Examples include: costs of an electrician wiring machinery and equipment necessary for the job, and laborers required to move a piece of machinery from one place to another in the workshop.

4. Add all individual costs.

5. Add in an allowance factor. This percentage, when added to the setup costs, allows for modifications of setups which may occur before or after production begins. Individual experience is the best determiner of this percentage; however, a range of 10-20% would not be unreasonable.

6. Total the costs. Add the allowance to the setup cost estimates to arrive at a total projected setup cost to be included when bidding

Figure 2A

JOB SETUP SPECIFICATION SHEET

1. Job Title: _____

2. Floor Space Required: _____ square feet _____

3. Cleanliness/Climate Requirements:

4. Equipment Required:
   A. On-Hand:

   B. To Be Purchased:

5. Equipment Requiring Relocation (including freight/moving expenses):

6. Electrical Wiring Requirements:

7. Plumbing/Hydraulic/Air Systems Required:

8. Other Factors Required:

Figure 2B

1. Job Setup

Description	Bids/Estimates #1	#2	#3	Allowance Factor (for modifications)	Adjusted Cost of Setup
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
TOTAL					

Figure 3

CONTRACT BID RECORD

JOB _____ WORKSHOP CONTRACT NO. _____

CUSTOMER _____ DATE BID PREPARED _____

ADDRESS _____ DATE BID SUBMITTED _____

_____ DATE BID ACCEPTED _____

_____ DATE BID REJECTED _____

TELEPHONE NO. _____

CONTACT PERSON _____ PERSON PREPARING BID _____

TITLE _____

DESCRIPTION OF JOB _____

_____

_____

TOTAL COSTS

A. DIRECT COSTS

1. job setup _____
2. direct labor _____
3. direct materials _____
4. freight _____
5. machinery and equipment _____

TOTAL _____

B. INDIRECT COSTS

1. percentage amount applied _____%
2. total of direct labor cost (see A.) _____

TOTAL INDIRECT COST (#1 x #2) _____

C. OVERHEAD

1. percentage amount applied _____%
2. total direct labor cost (see A.) _____

TOTAL OVERHEAD COST (#1 x #2) _____

D. PROFIT

1. Direct Cost _____
2. Indirect Cost _____
3. Overhead _____

Total Costs _____

percentage of profit _____%

Profit on Job (total costs x % profit) _____

BID PRICE

A. Direct Cost _____
B. Indirect Cost _____
C. Overhead _____
D. Profit _____

TOTAL _____

the job. For example: job setup costs for a particular assembly job have been calculated to cost approximately $1,500. Modifications are expected with the setup once the production begins. The workshop has decided that 15% allowance would be reasonable for such modifications. Thus,

$1,500 setup cost
x 15% (.15) modification allowance
$ 225 modification cost

$1,500 + $225 = $1,725 total job setup cost.

7. Record all data. Document all planning, methods, and cost estimates. Enter the figures on a job setup sheet which will show total cost when all figuring is complete. (Figure 2B on page 11). Such sheets may prove helpful when projecting setup costs on future jobs with similar elements.

8. Transfer the total projected costs figure to a sheet showing all direct costs.

   Observe Figure 3 on page 13 of this publication. This is one such contract bid record which could be used to calculate prices for a proposed job. References will be made to it throughout this publication. It is the key form for having a written record of any bid submitted by the workshop.

Direct Labor

The second element of direct cost is direct labor. Titus (1976b) defined direct labor cost as "those wages paid to the workers who actually perform the tasks necessary to transform raw materials or parts into a finished product" (page 18). Titus further explains that "even though the work performed by such personnel as supervisors, material handlers, or quality control inspectors is essential to the production of a finished product of acceptable quality, they do not do the actual work. Their job functions are purely supportive in nature" (page 18). These individuals, then, fall within the category of indirect labor, which will be discussed in the next section. Examples of direct laborers include: automobile assemblers, machine operators, welders who are welding metal beams for construction of a building, and packers who are placing light bulbs into a large container.

Determining accurate direct labor costs is essential when preparing the bid as direct labor makes up a large percentage of the cost of many jobs. Direct labor costs also form the base for the other two major areas of determining bid price, Indirect Costs, and Overhead. These costs are percentages of the direct labor cost. Because of this, special attention must be given to the procedures involved in determining direct labor costs.

First, complete a time study for all direct labor elements in the job. Time standards used in cost estimating for the workshop must be based on the

normal worker, working at an average pace, and including allowances for personal, fatigue, and delay time. Hietala (1978) has said, "since we are seeking a time standard which represents 100% or normal performance, we must select an operator close to this performance goal. Though many sheltered employees do represent normal or near normal performance, the use of a staff person is recommended. Time studies are needed immediately or on a complex method, require the flexibility of a staff person as operator" (page 17). Hietala has further added that "the staff person selected must be trained to use the specific work methods and tools. After the training, time must be allowed for the operator to become proficient in the method. The length of time required for this learning phase will depend on the job" (page 17). Whether the workshop uses staff members or clients for the time study, it is very important that the individual used be at or close to normal performance (100%) for that specific job.

Secondly, obtain prevailing industrial wage rates for all of the direct labor jobs (these were the jobs studied in the previous paragraph). A prevailing wage is one which is paid to an average experienced industrial worker for performing a specific job in a particular geographic area. Such wage rates can usually be obtained from either the Wage and Hour Division of the U.S. Department of Labor or from the local State Bureau of Employment. The U.S. Department of Labor, within its Regulation 525 - Employment of Handicapped Clients in Sheltered Workshops, has discussed prevailing wage rates. Regulation 525.9 (g) (1) states that:

> The wage rates paid handicapped workers working at piece rates shall not be less than prevailing piece rates paid nonhandicapped employees in the same work in the vicinity in industry maintaining approved labor standards. In the absence of industry piece rates, time studies or other tests may be used by the workshop to establish piece rates. Such time studies should be made with nonhandicapped persons, although handicapped workers may be used in those situations where they are not handicapped for the type of work being tested and their production is comparable to that of nonhandicapped persons of average ability. The base hourly rate used in making time studies must not be less than the prevailing rate in industry for work requiring similar skill.

The prevailing wage rate must be used in order to pay clients a commensurate wage. A commensurate wage can be defined as "a wage paid to a handicapped worker which is comparable to wages paid to a nonhandicapped worker in the vicinity, performing similar work at a specific quality level, with the quantity factor being the main variable" (Cawood, 1976, p. 18).

Finally, calculate direct labor costs. To do this accurately and effectively, it is important to have a clear understanding of the terms used for calculating direct labor costs. These terms and their definitions are:

> TIME STUDY: "The procedure by which the actual lapsed time for performing an operation or subdivisions or elements thereof is determined by the use of a suitable timing device and recorded. The procedure usually, but not always, includes the adjustment of the actual time as the result of performance rating to derive the time which should be required to perform the task by a workman working at a standard pace and following a standard method under standard conditions." (Maynard, 1971, p. 12-27) In other words, it is a method of determining how

long (in time) it should take an average, experienced worker. A clock, stopwatch, or other timing device is used and the time that elapses while the task is being performed is recorded.

When a series of time studies are completed, an average time for the completion of the operation can then be calculated.

AVERAGE TIME: "The arthimetical average of all the actual times, or of all except the abnormal times, taken by a workman to complete a task or an element of a task." (Maynard, 1971, p. 12-5) Simply stated, average time refers to a number of timings done on the same element or portion of the task with the timings added together and divided by the number of observations in order to arrive at the average time for the element or task. For example, five time studies were taken for a particular task, with the times being: 21 seconds, 24 seconds, 22 seconds, 23 seconds, and 21 seconds. A total time of 111 seconds is obtained when the five are added together. By dividing this total time of 111 seconds by the number of time studies (5), an average time of 22.2 seconds is obtained.

Sometimes the individual that is time studied is not performing the task(s) at the normal level (100%). When this occurs, a performance rating is necessary and must be calculated together with the average time in order to arrive at a normal time for the operation. Otherwise, direct labor costs will have been based on times not normal for completion of the task(s), and will either be more or less than if completed in a normal amount of time.

PERFORMANCE RATING: "Is the observer's judgment of the performance level of the person (average nonhandicapped) performing the elements, operation or task. Normally expressed as a percentage of performance and determined by what would be considered as a fair day's work by a normal/average individual." (U.S. Department of Labor, 1978b, p. 11) Stated simply, the analyst assigns a performance rating to the worker who was being observed. This rating is subjective in nature and is based on experience and judgment. The rating is a judgment of the skills and pace the observed worker exercises in comparison to normal skills and pace. The rating could be over 100%, under 100%, or the same as that of a normal worker (100%). For example, a time studied worker is judged to be putting forth 20% more [effort] than a normal worker. The performance rating would then be set at 120% or 1.20 (100% or 1.00 being normal). The average time is then multiplied by the performance rating of 1.20 to arrive at the normal time for the task. Thus, if the task takes Worker A 50 seconds to complete (average time), and a performance rating of 1.20 or 120% is assigned, then the normal time for the job task is calculated as follows: 50 seconds x 1.20 = 60 seconds. In the case where a worker is judged to be putting forth 15% less [effort] than a normal worker,

the performance rating would then be set at 85% or .85. Thus, if the task takes Worker B 45 seconds to complete (average time), then the normal time for the job task is calculated as follows: 45 seconds x .85 = 38.25 seconds.

Nonhandicapped individuals will most often be the ones time studied for the job tasks within the workshop as it will be easier to rate their performance. Errors will be less likely to occur. As performance rating is not intended to compensate for a handicap, only for the differences in skills and pace among normal workers, handicapped individuals could be used as time study subjects when their handicapping condition does not interfere with their ability to complete the job task(s).

NORMAL TIME: "The time required to complete one unit computed by adjusting actual time by the efficiency rating assigned to each worker used for time studies." (Titus, 1976a, Appendix A) It is the time a normal worker (experienced) would require to perform a specific task, not including allowances for personal, fatigue, and delay time. Normal time is calculated by multiplying the average time by the performance rating. See the examples given within the definition of performance rating above.

If normal time does not allow for personal, fatigue, or delay time, what happens if the worker requires any or all of these allowances? The U.S. Department of Labor has required that allowances be used to compensate for interruptions that the average operator will experience.

ALLOWANCE: "A time increment included in the standard time for an operation to compensate the workman for production lost due to fatigue and normally expected interruptions, such as for personal and unavoidable delays. It is usually applied as a percentage of the normal or leveled time." (Maynard, 1971, p. 12-4)

The U.S. Department of Labor, Employment Standards Administration, Wage and Hour Division, in its pamphlet entitled Cost Estimating Procedures for Sheltered Workshops (1978) has stated that:

> Many conditions will control the allowance factor, however, an average allowance of 20% will normally cover activities performed within workshops. For example, a 50 minute task multiplied by 1.2 would provide an allowed time of 60 minutes to perform the task. However, each project must be evaluated individually, and should conditions warrant the percentage, should be adjusted in accordance with the task to be performed. (p. 10)

For example: if the normal time for a job is 40 seconds, and it has been determined that a 20% allowance should be added to compensate for worker fatigue, breaks, and delays, then the following calculations would take place:

40 seconds	40 seconds (normal time)
x20% (allowance)	+ 8 seconds (allowance)
8 seconds	48 seconds (standard time)

Allowance figures can also be added to costs to account for things like rework, scrap, or other unknown variables. For example: if the material cost for a product is $ .30 per unit, and loss and scrap are figured to be 10%, then:

$ .30 per unit	$ .30 per unit
x 10% (allowance)	+.03 per unit allowance
$ .03 per unit allowance	$ .33 per unit (standard cost)

It has been stated above that when allowances are added to the normal time, a standard time is obtained.

STANDARD TIME: "The normal or leveled time plus allowances for fatigue and delays." (Maynard, 1971, p. 12-25)

The standard time is the final estimate of how much time an average nonhandicapped worker, working at a normal pace and with normal delays, would take to perform a task. The final term and its definition is that of piece rate.

PIECE RATE: "The amount of money paid for a unit of production. It serves as the basis for determining the total remuneration paid an employee working under a piecework incentive plan." (Maynard, 1971, p. 12-20)

METHODS OF CALCULATING DIRECT LABOR COSTS

When the procedures involved in determining direct labor costs have been followed and the terms and their definitions understood, direct labor cost calculations can begin. Direct labor costs can be determined on (1) piece rated jobs, or (2) hourly-rated jobs.

Piece rated job calculations will be discussed first. It is a common fact that the average worker spends only a portion of each working hour actually performing the work tasks. The remainder of the hour is consumed by his personal needs (e.g., coffee breaks, conversing with co-workers about nonwork related subjects, toilet needs, rest periods, or getting a drink of water). A part of each hour may also be taken by waiting time. The worker, though ready for work, may be required to wait for supplies, for repairs to machinery or equipment, for instructions, or for other job related delays. Caddick (1979) has discussed the relevancy of the 50 minute hour for the rehabilitation workshop by stating that:

> The 50 minute hour has been proposed and widely used in industry to indicate that 10 minutes out of each hour is being set aside for the personal needs or job delays . . . For most workshops, however, this 50 minute hour is unrealistic. Workshops are not that well managed. (Nor, for that matter, are many profit-seeking businesses). Hence, the use of a 45 minute hour (2700 seconds) is suggested unless you can demonstrate that the management of your workshop is so efficient that clients <u>really</u> have an opportunity to work some greater portion of the hour. In some workshops where the foreman-supervisor to client ratio is quite high (1 to 15 to 20 or more) a 40 minute hour might even be more realistic. In no case should a workshop go beyond the 50 minute figure, however, for this represents the ideal used by large companies with good working conditions. (pp. 74-75)

The workshop does have the option to calculate direct labor costs on a 60 minute hour method. However, when this method is used, the workshop must divide the prevailing hourly wage (found in industry) for the job by the standard time for the job expressed in pieces per hour. With standard time, allowances are incorporated into the normal time for completing the job tasks. The difficulty with this method rests with the determination of the percentage amount of allowance. This percentage may vary with each job in the workshop, and the workshop may not be able to accurately determine the percentage amount. For this reason, workshops should give strong considerations to using the 60 minute method. In most cases, they are best advised to use either the 50 minute method, 45 minute method, or some other method based on the actual time a worker is actually performing work tasks.

When the 50 minute hour method (or 45 minute hour method) is used, the prevailing hourly wage (found in industry) for the job is divided by the normal time for the job expressed in pieces per hour. Recall that normal time does not include allowances. It is instead assumed that a worker will only be productive for 50 (or 45) minutes out of every hour, and the pieces per hour is calculated with this assumption in mind. For example:

Normal time . . . . . 30 seconds
seconds in 50 minute hour . . . . . 3000 seconds
Prevailing Hourly Wage. $5.00

Therefore, 3,000 seconds ÷ 30 seconds (normal time) = 100 pieces per hour

$5.00 (Pre. Hrly. Wage) ÷ 100 pieces per hour = $ .05 per unit

Thus, the direct labor cost is $ .05 or 5¢ per unit (or piece).

So that the reader will have the opportunity to absorb this important and crucial element of the contract bid, an example has been provided on the following page.

EXAMPLE FOR DETERMINING DIRECT LABOR COSTS ON A PIECE RATED METHOD

Suppose a job task has been time studied five times, with results being 32 seconds, 28 seconds, 31 seconds, 27 seconds, and 32 seconds. The total time for the five time studies is 150 seconds. The performance rating is estimated to be 90%, and the prevailing hourly wage is determined to be $5.00 per hour. With this information, direct labor costs can be calculated. The workshop has decided to use a 50 minute hour method for purposes of calculation.

1. Time Study the Job

   32 sec. + 28 sec. + 31 sec. + 27 sec. + 32 sec. = 150 seconds (total time)

2. Compute Average Time

   (total time ÷ # time studies)

   150 seconds
   ÷ 5 time studies
   30 seconds (average time)

3. Determine Performance Rating

   estimated to be 90% (.90) — 90% (.90)

4. Compute Normal Time

   (average time x performance rating)

   30 seconds (average time)
   x90% (.90) (performance rating)
   27 seconds (normal time)

5. Obtain Prevailing Hourly Wage for Job

   determined to be $5.00 per hour — $5.00 per hour

6. Calculate Pieces Per Hour (50 minute Method)

   # seconds in 50 minutes = 3,000 seconds

   3,000 seconds
   ÷ 27 seconds (normal time)
   111.1 pieces per hour

7. Calculate Direct Labor Cost Per Piece

   (prev. hrly. wage ÷ pieces per hour)

   $5.00(prev. hrly. wage)
   ÷111.1(pieces per hour)
   $.045 per piece direct labor cost

8. Calculate Direct Labor Cost for Job

   (direct labor cost per piece x total pieces)

   If the job calls for the completion of 1,000 pieces, then $ .045 (per piece cost) is multiplied by 1,000 (total pieces). Total direct labor cost then becomes $45.00 for the job.

Direct labor costs often must be calculated on an hourly basis for jobs which don't lend themselves well to piece-rating. Examples of such work include: service contracts involving janitorial work or groundskeeping, and salvage work. A number of jobs may initially have hourly-rated direct labor costs as a result of their complexity, and large numbers of variables. Eventually, enough production data may be obtained so as to bid the job on a piece-rated basis. For example: janitorial work is often bid on an hourly rate; however, data can be obtained on the number of square feet of a building to be cleaned, waxed, and buffed. Time studies can be completed on each aspect with time values divided by the number of square feet. Wages can then be determined by dividing prevailing wages by square feet per hour. The resulting figure indicates a price per square foot which can be paid to clients. Hourly rates are based on the prevailing wage rate found in industry and incorporate allowances. As with piece rates, clients are paid according to their performance. The procedure for determining direct labor cost for hourly-rated jobs is as follows:

(a) time study the job

(b) determine average time

(c) assess the operator's performance rating

(d) compute normal time (b x c)

(e) determine the amount of allowances

(f) compute standard time (d x e)

(g) obtain the prevailing wage rate for the job from industry

(h) compute direct labor unit cost for the job (f x g)

This process can be repeated for each separate task involved in the job, and a total direct hourly labor cost will be arrived at.

So that the reader will have the opportunity to absorb this important and crucial element of the contract bid, an example has once again been provided. Please refer to the following page.

EXAMPLE FOR DETERMINING DIRECT LABOR COSTS ON AN HOURLY RATED METHOD

Suppose a job task has been time studied five times (wet mopping 1,000 square feet), with results being 32 minutes, 27 minutes, 31 minutes, 32 minutes, and 28 minutes. Total time for the five time studies is 150 minutes. The performance rating is estimated to be 80%, allowances are estimated to be 20%, and the prevailing hourly wage is determined to be $4.00 per hour for similar work in industry. With this information, direct labor costs can be calculated. The method is as follows:

1. Time Study the Job

   32 min. + 27 min. + 31 min. + 32 min. + 28 min. = 150 minutes (total time)

2. Compute Average Time

   (total time ÷ # time studies)

   150 minutes (total time)
   ÷5 (total time studies)
   30 minutes (average time)

3. Determine Operator's Performance Rating

   estimated to be 80% (.80) — 80% (.80)

4. Compute Normal Time

   (average time x performance rating)

   30 minutes (average time)
   x80% (.80) (performance rating)
   24 minutes (normal time)

5. Determine Allowances

   (normal time x allowance percentage)

   24.0 minutes (normal time)
   x 20% (allowance)
   4.8 minutes (allowances)

6. Compute Standard Time

   (normal time + allowances)

   24.0 minutes (normal time)
   +4.8 minutes (allowances)
   28.8 minutes (standard time)

7. Obtain Prevailing Hourly Wage for Job

   determined to be $4.00 per hour — $4.00 per hour

8. Calculate Direct Labor Cost

   (prev. hrly. wage x standard time)

   $4.00 per hour (prev. hrly. wage)
   x28.8 minutes (standard time)
   $1.92 per 1,000 square feet, direct labor cost

You may be wondering how a cost can be obtained by multiplying an hourly figure by a minute figure. The correct mathematical equation would be as follows:

$$\$4.00/\text{hour} \times \frac{28.8}{60} = \$1.92$$

One dollar and ninety two cents is the direct labor cost for wet mopping 1,000 square feet of floor space. Thus, if 10,000 square feet of floor space is to be wet mopped, it would be safe to multiply $1.92 per 1,000 square feet by 10 to obtain a direct labor cost of $19.20 for 10,000 square feet of floor space.

FRINGE BENEFITS AND THEIR EFFECT ON DIRECT LABOR COSTS

If clients receive any type of fringe benefits such as vacation or sick leave, health insurance, social security contributions, or other such items, they must be added to the cost of direct labor. The facility accountant or bookkeeper often has direct financial records indicating the percentage of the total client payroll that is made up of fringe benefits. If there are no direct records, the percentage figure can be determined by dividing the prior year client fringe benefits by the prior year client wages. This percentage figure must be added to the direct labor cost.

For example:

$$\frac{\text{Prior Year Client Fringe Benefits}}{\text{Prior Year Client Wages}} = \frac{\$12,000}{80,000} = 15\%$$

Referring to the example on calculating direct labor cost for piece rated jobs (page 21), the following procedure should be followed:

If:

Cost Per Unit	= $ .045
x Fringe Benefits	15% (.15)
Fringe Benefits per Unit Cost	= $ .00675

Then:

Cost Per Unit	= $ .045
+ Fringe Benefit per Unit Cost	.00675
Adjusted Direct Labor Cost Per Unit	$ .05175

Referring to the example on calculating direct labor cost for hourly rated jobs (page 23), the following procedure should be followed:

If:

Cost/Wet Mopping 1,000 sq. ft.	= $1.92
x Fringe Benefits	15% (.15)
Fringe Benefits per 1,000 sq. ft. cost	= $ .288

Then:

Cost/Wet Mopping 1,000 sq. ft	= $1.92
+ Fringe Benefits per 1,000 sq. ft.	= .288
Adjusted Direct Labor Cost per 1,000 sq. ft.	= $2.208

Adjustments in the percentage amount will be necessary whenever fringe benefits are changed.

When calculating direct labor costs, be sure to document all calculations for future reference. The use of some type of direct labor calculation sheet may lessen the possibility of errors or omitted items. Figure 4 on page 25 of this publication presents one such direct labor cost sheet which could assist in this area. Total Direct Labor Cost should be transferred to the Contract Bid Record (Figure 3 on page 13).

Figure 4

DIRECT LABOR COST SHEET

2. Direct Labor Operation	Time Trials #1	#2	#3	#4	#5	Total of Time Studies	Ave. Time	Perf. Rating	Normal Time	%age Allowance	Standard Time	Commen. Hrly Wage	Pieces Per Hour	Cost Per Piece

TOTAL _____

Pieces to be produced _____ x Cost per piece _____ x Fringe benefit factor _____% = TOTAL DIRECT LABOR COST _____

Direct Materials

Having discussed the first two components of direct cost, i.e., job setup and direct labor, it is now important to discuss the third component of direct cost, direct materials. Maynard (1971) has defined direct materials as "all material that enters into and becomes part of the finished product (including waste), the cost of which can be identified with and assessed against a particular part, product, or group of parts, or products accurately and without undue effort and expense" (p. 12-8). It would be difficult, then, to produce the goods or provide the services without these materials. Direct materials, then, are traceable to a specific product. The following examples should assist in understanding what constitutes a direct material:

EXAMPLE 1: The workshop has several packaging jobs. Each job requires that the finished products be packaged into cardboard containers for shipping purposes. Each job requires a container size different from the other jobs. Job specifications for each job requires that reinforced, gummed tape be used to seal the containers.

(a) The cardboard containers (for each job) should be regarded as direct materials as they are traceable to a specific job.

(b) The reinforced, gummed tape cannot be regarded as a direct material as it cannot be traced to a specific product. Rather, it is categorized as being an indirect material (see page 40 of this publication).

EXAMPLE 2: The workshop has a contract for making wood pallets. The workshop is to supply everything for the job. All wood and nails used in making the pallets are regarded as direct materials as they are traceable to a specific product. Shipping requirements of the contractor include using steel band to band groups of ten pallets together. Since the steel band is used for other contract jobs within the workshop, the amount used on the job is regarded as an indirect material cost (see page 39).

Consideration: Any materials generally regarded as indirect materials could become direct materials provided an unusually large amount of the material is required for the contract job.

For example, staples used to close boxes or plastic bags are generally included with indirect material cost due to their common usage among many contract jobs; however, if a particular contract job requires an unusually large quanitity of the material, then the material should be included in direct material cost.

Since workshops often purchase the direct materials which are used in connection with the contract jobs received from industry, it is important that correct pricing procedures be followed for these materials. Prior to determining direct material cost, the workshop must: (1) obtain or develop complete specifications for the proposed job, including the materials to be used, (2) analyze the job, and (3) decide upon the production method to be used. Point 1 includes a description of the materials required for the job, the party responsible for providing the material, and the quantity of the material needed. Sometimes it is impossible to know all of the above information prior to the actual running of the job. When this occurs, the workshop should determine the amounts to the best of its ability and make adjustments once the job has started. Obtain an agreement from the contractor prior to doing this so there will be no misunderstanding on either side.

CALCULATING DIRECT MATERIAL COSTS

Steps are as follows:

(1) Locate sources of supply for the materials

(2) Obtain firm price quotes in writing, outlining: what will be supplied (exact material), quantity to be supplied, length of time price quotes will be in effect, lead or delivery time, and any freight or delivery charges to the workshop.

(3) Determine how much material will be used in each unit of production. A small error in calculating material usage for one piece or unit can become a very large error when multiplied by 100,000 pieces. To better determine exact material usage:

Obtain samples of the finished product. This may provide some insight into how the materials are used.

Visit a site where the work is now being done. This may give insight into manufacturing processes and material usage.

Get assistance from the sales personnel or technical assistance departments of the companies who wish to sell materials to the workshop. The field sales representatives of material suppliers are valuable resources for the workshops regarding material usage.

(4) Convert the "price per unit" in the materials quote (from suppliers) to the unit of measure used in the estimate of materials usage per unit. Materials are usually priced on a per unit basis (per pound, per gallon, per square yard, etc.).

(5) Multiply units of use times the "price per unit" to arrive at a "per unit of production" materials cost.

EXAMPLE: 1. Price of material needed for a job is quoted at $4.00 per pound delivered.

2. It has been determined that three ounces of material will be required for each unit of production.

3. The price per pound ($4.00) is converted to a price per ounce ($4.00 ÷ 16 oz/lb. = $ .25).

4. The per ounce price ($ .25) is multiplied by the number of ounces needed per unit (3) to arrive at a per unit direct material cost ($ .25 x 3 = $ .75).

If the per unit usage and the "price per" are quoted in the same terms (i.e., both ounces), there is no need to convert, only to multiply price per unit by units of usage. For example, the price of the material is quoted as $.10 per ounce. If two ounces are required for each unit of production, per unit direct material cost is $ .20 ($ .10 x 2 ounces). The workshop may, at times, have to consider other factors which could alter direct material cost. They are as follows:

(a) The workshop should be aware of the unit of measure a particular material is available in and how closely that unit of measure matches usage per unit.

EXAMPLE: A product requires a piece of material nine inches in length. The material is sold only in 10 inch lengths. Thus, the material cost per unit should be based on 10 inches of material per unit, not nine inches, since there will automatically be one inch of waste per piece.

(b) The workshop should allow a certain percentage for losses of materials that are wasted, damaged, or ruined in the course of the manufacturing process. While this is not a desirable situation, it is one that is accepted and allowed for by industry and workshops should do likewise. The business providing the contract work may be able to provide the workshop with this percentage if they have done the job in the past.

(c) The workshop should also allow a percentage for its cost of obtaining and handling the direct materials.

A figure of 10-20% of the cost of direct materials is sometimes used for (b) and (c), but is it difficult to state an actual percentage figure that can be used universally since these types of costs and potential losses are dependent on the type of material being used, the complexity of the manufacturing process being utilized, the condition of the equipment, the skill level of the employees, and other factors.

It is important that workshops keep losses to a minimum and document them for future reference. Businesses can't be expected to pay for excessive material usage by the workshop, and the net result of these losses can result in a decrease in income or removal of the job from the workshop. It may be more desirable for the workshop to have the direct materials purchased or supplied by the company they are doing work for. This will free the workshop of the financial risks involved in purchasing large quantities of materials, and minimize other risks such as ordering the wrong materials or quantity of materials. The materials purchased by the company doing business with the workshops are <u>still the responsibility of the workshop</u>. Care must be taken to protect these materials from loss,

damage, or excessive use or waste since the workshop is financially accountable for all of the materials delivered to them. When all direct materials for a job are identified with a per unit price established and a percentage added for scrap, loss, waste, handling, etc., the costs should be totaled on a direct materials cost sheet and the figure incorporated into the bid price. See Figure 5 on page 31. Transfer Total Direct Materials Costs to the Contract Bid Record Form (Figure 3 on page 13).

Freight

The fourth component of direct cost is freight. Whenever a workshop produces goods, raw materials are shipped in and finished goods shipped out. Moving these goods results in added expenses. Such expenses are known as freight expenses, and when they relate to a specific product, they are regarded as direct costs.

Either the customer or the workshop will be responsible for the freight expense. This must be determined before a bid price is established. If the customer is responsible for freight expense, the workshop will not include this cost in its bid. However, if the workshop is responsible for freight expenses, then these costs must be determined. In order to accurately arrive at freight costs, several factors must be known:

What are the points of origin and destination of both incoming and outgoing goods?

What is being shipped (cardboard, steel, plastic, etc.)?

Does the freight require special handling, or added insurance?

How is it to be packed and shipped (pallets or boxes, air freight or truck)?

What is the weight and quantity?

Who will be responsible for the transportation?

Once these factors are known, rate clerks at various shipping companies can provide accurate estimates as to total freight charges. If the workshop uses its own truck(s) for hauling specific production work, it must charge for its use under the freight expense category or the result will be an inaccurate bid.

There are several ways to calculate workshop transportation charges; perhaps the most accurate method is to obtain a cost per mile by dividing total transportation expenses from the prior year by total miles driven.

$$\frac{\text{Total Transportation Expenses (prior year)}}{\text{Total Miles Driven (prior year)}} = \text{Average Transportation cost per mile driven}$$

Figure 5

DIRECT MATERIALS/SUPPLIES

Description	Price of Material	Price Per Piece of Material	Amount of Material Required Each Piece	Price Per Piece of Production	Allowances (Losses)	Total Price Per Piece of Production

TOTAL _____

Pieces to be produced _____ x Cost per piece _____ = TOTAL DIRECT MATERIAL COST _____

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Figure 6

FREIGHT SPECIFICATION SHEET

Job: _____ Date: _____

1. Point(s) of Origin for Goods Incoming:

2. Point(s) of Destination for Goods Shipped:

3. Destination of Materials to be Received:

4. Description of Materials to be Shipped:

5. Mode of Transportation:

6. Method of Packing/Shipping:
   (i.e., pallets, boxes/air freight, truck)

7. Weight and Quantity of Materials:

8. Estimated Freight Charges:

9. Name and Address of Freight Handlers:

10. Time Information Guaranteed for Accuracy:

The accountant or bookkeeper for the workshop should have records pertaining to vehicle expenses. Vehicle costs should include, but not be limited to, the following: wages (including fringe benefits) of drivers and helpers, insurance costs, and vehicle costs such as maintenance, fuel costs, and depreciation. Thus, if total transportation expenses for the prior year were $10,000 and the total miles driven were 25,000, cost per mile would equal $ .40.

$$\left(\frac{\$10,000}{25,000 \text{ miles}} = \$ .40 \text{ per mile} \right)$$

Therefore, if the workshop determined that a contract would require 200 miles of vehicle driving, transportation costs would be $80 ($ .40/mile x 200 miles = $80).

In addition to transportation charges for subcontract work, transportation charges can also be determined for service contracts such as janitorial or landscaping, where workshop employees are transported to and from the job site(s). Again, vehicle expenses should be determined on a cost per mile basis. One option to using the workshop's own vehicle(s) for subcontract or service contract work involves leasing the vehicle(s). Once again, all expenses pertaining to leasing should be calculated and a cost per mile figure obtained.

Figure 6 on page 33 of this publication is an example of a freight specification sheet which can be used by a workshop to determine freight expenses. Freight expenses and specifications should be documented on a form such as this, with total freight expenses being added to the Contract Bid Record Form (Figure 3 on page 13).

Direct Machinery and Equipment

The fifth and final component of direct cost is that cost related to machinery and equipment. Machinery and equipment can be treated as a direct cost provided its use can be traced to a specific product or service. For example, if the workshop purchases a specialized staple gun for one specific contract job, then the cost of this staple gun can be regarded as a direct cost. However, a conventional stapler used for many jobs throughout the workshop is considered to be an indirect cost.

There are exceptions which should be considered by the workshop. Any piece of machinery or equipment could be considered as a direct cost though it will be used on other contract jobs (current or future). For this to occur, the workshop would use a portion or percentage of the cost of the piece of machinery or equipment as a direct cost. This cost must be accurate and hinges upon the ability of the workshop to calculate it, based on such information as original cost, amount of prior use, depreciation, and life expectancy. Conventional staplers, tooling, machinery and equipment, having relatively small utilization and/or costs are usually not worthwhile for separating out direct cost. Rather, they are placed under indirect costs. This is a decision each workshop will have to make.

Once the machinery and/or equipment have been determined to be direct cost items, the amount to be charged to the job or contract can be calculated.

The method of calculation will vary from job to job and is dependent on several factors:

(a) if the piece of equipment will be purchased for a specific job, used for the entire job, and discarded or never used after completion of the job, then the entire cost should be charged to the contract or bid,

(b) if the piece of equipment will be purchased for a specific job, but used on future jobs, then a portion or percentage of the equipment cost will be treated as a direct cost. This can be done by estimating current and future use of the equipment in question,

(c) if the workshop already owns a specialized piece of machinery or equipment suited for the contract, then cost data should be developed showing original cost, amount of prior use, depreciation, and expected life. Once this data is gathered, costs can be calculated for machinery or equipment.

For example, a machine had been purchased one year ago for $20,000, with an estimated life of five years, at a production output of one million pieces per year (five million total). The workshop has used the machine sparingly. To obtain a "per piece" machinery cost, divide original price by life expectancy output ($20,000 ÷ 5,000,000 = $ .004 per unit of production direct equipment cost). The contract being bid calls for 300,000 units to be produced. Thus, 300,000 pieces x $ .004 per piece price = $1,200 for direct equipment cost.

Jigs and toolings for specific jobs can also be charged as a direct cost. A jig (Maynard, 1971) "is a work-supporting, work-holding, and tool-guiding device (pp. 12-13). A tool (Carson, 1967) "is a device or element designed and used for the express purpose of removing material from a work piece under controlled or stable conditions (p. 21-1). Jigs or tools could be of a general or reusable type, or a specialized variety useful only on a specific job. The same procedures can be used here as were used with equipment. Review the figures from the setup area with these figures to insure that overlapping or oversight does not occur with these closely related items. For example, if a jig is constructed which required electricity, and the installation of an electrical line was included with the job setup cost, then only that part of the cost of developing the jig above and beyond the installation of the electrical line would be included here.

The maintenance of direct equipment is normally considered a part of overhead expenses; however, if a particular piece of equipment requires frequent adjustment and/or repair, it is proper to include an amount for this repair within direct cost. These costs are usually estimates, relying on historical data within the workshop or by consultation with manufacturers of the equipment.

There are other maintenance factors pertaining to machinery and equipment which could be attributed to a specific job, and must be included within direct cost. Such factors include: large power consumption, excessive storage and handling costs, and excess scrap or waste generated by the contract. Examine these factors closely, and incorporate within the direct cost if need be. Note Figure 7 on page 37. Again transfer Total Machinery/Equipment Cost to the Contract Bid Record Form (Figure 3 on page 13).

Figure 7

5A. Machinery/Equipment

Description	Life Expectancy (Pieces)	Cost of Equipment & Machinery	Pieces to be produced for job	Percentage of Life Expectancy	Cost Per Piece	Direct Equipment and Machinery Cost
1.						
2.						
3.						
4.						
5.						
6.						
					TOTAL	

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5B. Related Machinery/Equipment Costs

	Description	Cost
Jigs/ Toolings	1.	
	2.	
	3.	
	4.	
	Total Jig/Tooling Cost	
Maintenance		
Power Consumption		
Storage/Handling		
Excess Scrap/Waste		
TOTAL COSTS		

(1) TOTAL DIRECT MACHINERY/EQUIPMENT COST

(2) TOTAL DIRECT RELATED MACHINERY/EQUIPMENT COST

(2) TOTAL MACHINERY/EQUIPMENT COST

SUMMARY OF DIRECT COSTS

Direct costs should be entered on a Contract Bid Form and totaled. Since these costs represent a large percentage of any bid submitted by the workshop, care must be taken. Errors will result in unrealistic figures. Some areas of direct costs calculation do rely on educated guesswork and estimation; however, careful examination of all factors and continued practice (through experience) should result in the calculation of accurate direct costs.

2. INDIRECT COSTS

Indirect costs are "those that cannot be traced directly with the manufacture of a specific piece part, subassembly or product, such as those items necessary to operate and maintain the workshop but not directly traceable to one specific project" (U.S. Department of Labor, 1978a, p. 9). Examples would include: production supervisor's salary and fringe benefits, contract procurement or sales expenses, and the cost of maintaining material handlers and shipping crews who make most production areas function smoothly. Indirect costs are costs necessary for the production unit to operate; however, they are costs which cannot be charged to any one job. For example: production supervisors are necessary for the production unit to function effectively. The cost of their salaries and benefits can be separated from the cost of running the rest of the workshop. However, it would be difficult to charge the cost of their services to any one job because they may be working on more than one job or involved with rehabilitation services. Therefore, they are an indirect expense. The same holds true for sealing tape (used on cartons or forms) and supplies used in shipping. These are also indirect expenses.

Indirect costs are divided among or absorbed by all jobs in the workshop. Each contract or bid must contain a provision for covering indirect costs associated with operating the production department. These costs will remain relatively constant even if production work levels fluctuate, as they are computed into the overall cost of the job by applying them as a percentage of direct labor.

Components which make up indirect cost include: indirect labor, indirect materials and supplies, supervision, administration, and indirect equipment. Each of these areas is included within the Indirect Cost Calculation Sheet (Figure 8 on page 45).

Indirect Labor

The first component of indirect cost is indirect labor. Indirect labor can be stated as: "those workers whose job assignments are necessary to the production of a product, but do not actually perform the tasks required to transform raw materials into a finished product" (Titus, 1976a, Appendix A).

Indirect labor cost, then, is the cost (wages and fringe benefits) of those workers who are necessary to support the functions of the production department in the workshop. Workers whose jobs are considered as being an indirect labor cost include: material handlers (who supply parts/materials to production workers, remove finished products, and organize the warehouse or storage areas); maintenance crews (who clean, maintain, and repair the production area, but only that area); shipping crews (who load, unload, organize, and direct incoming/outgoing shipments of production goods); truck drivers/helpers (who are employed by the workshop to deliver/pick up production goods). *If these employees are included within direct labor costs, then their wages should not become one of the expenses for determining vehicle expenses (page 35 of this publication); quality control/inspection personnel (who check quality/quantity levels of raw stock/finished goods through the workshop); and other personnel necessary for the production unit to function, but not assigned to one particular job.

Indirect Materials

The second component of indirect cost pertains to indirect materials. Indirect materials and supplies are those used on a variety of jobs throughout the workshop, and which would be difficult to trace to one specific product. Such materials include: shipping supplies, forms, staples, sealing tape, and other items used throughout the workshop production area on a variety of jobs.

Indirect material cost, then, is the cost of these items, including freight, plus a handling charge and allowance (10-20% is acceptable, but can vary with the situation) to cover scrap, losses, and the expenses of obtaining and stocking these supplies. For example: total indirect material cost for the prior year was determined to be $5,500. The workshop feels that a 10% allowance would be an appropriate amount to cover scrap, losses, or expenses of procuring the materials. This 10% allowance factor is added to the $5,500 to arrive at an adjusted total indirect materials cost of $6,050. ($5,500 x 10% = $550; $5,500 + $550 = $6,050.) There is no method which can accurately predict the amount of handling charges or allowances which should be included in the cost of indirect materials and supplies. Here, the workshop must rely on past experiences with the materials or supplies. Inventory or purchase records can provide information with the amounts that are consumed by the jobs. Analyzing the amount of loss or scrap from present jobs may be good indicators for the amount of loss or scrap on future jobs.

Supervision

The third component of indirect cost involves costs associated with supervision. Supervision costs are those costs (salary and fringe benefits) of individuals who supervise production work in the rehabilitation facility. Supervisors whose jobs are included within supervision costs are: client production supervisors, maintenance crew supervisors, shipping crew supervisors, and anyone else in charge of or supervisor of workers performing direct or indirect labor functions within the production unit.

Exclusions to this area include: counselors, social workers, speech therapists, or other individuals primarily performing rehabilitation services.

If certain production supervisors also perform rehabilitation functions, only their percentage of time involved with production supervision should be included within supervision costs.

Administration

Administration, the fourth component, is a broad area including many different functions within an organization. However, the scope of "administration" is much narrower with regards to indirect production costs. Here, administration refers only to the administration of the production unit. The costs involved would be the salaries and fringe benefits of administrators who function solely within the production unit and other administrative expenses necessary to maintaining the production unit. Examples of administration costs include: contract procurement personnel, sales and production bookkeeping expenses, production manager, sales commissions and salaries, general types of industrial engineering expenses (covering the production area in general, and not a specific job), and other administrative expenses related only to the production unit.

Indirect Equipment

The final component of indirect cost is that of indirect equipment. Indirect equipment is used throughout the production unit for many jobs, while direct equipment is used on one specific job. Examples of indirect equipment include: forklift and pallet trucks used throughout the workshop, shelving or racks used to store products, staplers, and sealing tape machines within the shipping/packing areas, worktables and chairs, and any other general or specific type of equipment used in the production area exclusively, and on a number of jobs.

The cost of owning and operating a truck could be an indirect expense provided the truck is used solely for production related work and has not been determined as a direct cost (under freight expense). Maintenance and repair of production equipment is considered an indirect expense, except when in connection with direct equipment requiring frequent repair or adjustment. In this situation, direct equipment expenses would include the maintenance expenses.

CALCULATING INDIRECT COSTS

The procedure for calculating indirect costs is as follows:

(1) Know and understand the elements comprising indirect cost.

(2) Obtain current information regarding: number of employees (including supervisors/administrators) working in each of the indirect areas, their current pay rates (including fringe benefits, the number of hours they work in a given pay period, and the number of hours (per pay period) that they are involved in the indirect function of production.

(3) Obtain current cost data on indirect material and supply purchases, and usage.

(4) Obtain current cost data on indirect equipment costs.

(5) Determine maintenance and repair costs for a recent period.

(6) With the workshop's accountant or finance officer, compare the current information with data from the past fiscal year. If certain costs have changed dramatically, make note of it.

(7) Determine what the cost was for the entire previous fiscal year for each element of indirect cost. Examine payroll data, repair records, purchase orders, and other sources which will yield the information desired. (The accountant or bookkeeper is the best resource for this information.)

(8) Make adjustments (up or down) on any costs that differ dramatically between last year and the current information.

(9) Total last year's adjusted indirect costs to arrive at a total indirect cost for the production unit for one year.

(10) Then, examine direct labor costs for a current period.

(11) Examine the workshop books for direct labor cost (including fringe benefits) for the last fiscal year. Determine total direct labor cost for the last fiscal year.

(12) Make adjustments (up or down) on any costs that differ dramatically between last year and the current information.

With the above steps completed, the calculations for determining how much indirect cost should be applied to each bid can take place.

Indirect costs are computed into the overall cost of the job by applying them as a <u>percentage of direct labor</u>. Procedures are as follows:

(1) Take the total indirect expenses for the previous year.

(2) Divide by the total direct labor expense for the same year.

(3) Multiply the answer by 100 to give you the percentage allowance of indirect costs to be used on all individual jobs.

(4) The amount of indirect costs to be applied to a specific job is then determined by multiplying the direct labor cost for the job by the percentage allowance of indirect costs.

For example:

From last fiscal year:

total direct labor cost = $220,000

total indirect cost = 85,000

$\frac{85,000}{220,000} \times 100 = 38.6\%$ (the percentage amount of indirect costs)

This figure (38.6%) is to be used throughout the year, unless significant changes occur within any area. Review this percentage quarterly and update the figure annually. Then, to determine the amount of indirect cost to be applied to a specific job:

Multiply the percentage amount of indirect costs = (38.6%) by the

Projected direct labor cost (for a specific job) = ($15,000)

$15,000 x 38.6% = $5,790 (indirect costs for the specific job)

SUMMARY OF INDIRECT COSTS

Determining whether something is of a direct or indirect nature, is difficult, to say the least. Continued experience in computing direct and indirect costs will provide the practitioner with the tools needed to develop accurate bids. When in doubt, ask board members, consultants, and staff. Someone may be able to shed some light and resolve the problem. Remember to transfer Indirect Cost computations to the Contract Bid Record Form (Figure 3 on page 13).

Figure 8

INDIRECT COST CALCULATION SHEET

1. CURRENT INFORMATION	1 No. Employees	2 Total Salaries/Benefit Per Pay Period	3 Total Manhours Per Pay Period	4 Hrs/Pay Period in Indirect Cost Area	5 Percent of #4 to #3	6 Total Salaries #2 x #5
Indirect Labor						
Supervision						
Administration						

TOTAL SALARIES APPLICABLE PER PAY PERIOD _____

Total Salaries Applicable Per Pay Period _____

Indirect Materials/Supply Purchases/Usage _____

Indirect Equipment Costs _____

Maintenance and Repair Costs _____

Period of Current Information _____

2. TOTAL ADJUSTED INDIRECT EXPENSES FROM PRIOR YEAR ( ) _____

3. TOTAL DIRECT LABOR EXPENSE FROM PRIOR YEAR ( ) _____

4. INDIRECT COST (2 ÷ 3) _____

5. INDIRECT COST AS A PERCENTAGE (4 x 100) _____ %

3. OVERHEAD

The third factor necessary for determining bid prices involves overhead. Titus (1976) defined overhead as "those costs which are incurred which are necessary for the function of the entire workshop that cannot be identified with any one department. Since these costs cannot be charged to any one department, they should be shared on a prorated basis by all departments" (Appendix A). Examples of overhead costs include: utility expenses, clerical and executive salaries, indirect labor and materials which cannot be broken out from the cost of running the entire facility, and any other expenses not of a direct nature. They are the costs of operating the workshop itself, and would most often continue regardless of the level of production or operation. In some cases, if a workshop had little or no production work, some overhead costs (e.g., electrical lighting or heating for production areas) would decrease.

With rehabilitation workshops there exists a number of expenses which must not be considered as part of overhead, though by definition, one would assume they would be included. These expenses are usually referred to as rehabilitation expenses or costs. Rather than discuss these costs now and confuse the reader, they will be discussed later in the publication. For now, it is important to discuss what is an overhead expense, and will be part of the bid price. There are two major areas with overhead: general administration and building and occupancy costs.

General Administration

General administration has two parts to it. The first part includes the cost of salaries and fringe benefits of workshop personnel such as the executive director, the workshop (or program) manager, the personnel director, purchasing and payroll department staff, all general secretarial help, and other individuals serving the entire workshop, not one department within the workshop. The second part includes the costs of materials, supplies, equipment, and other expenses necessary to support the functioning of the personnel listed above. The following items are included: all general office supplies (e.g., paper, pens or pencils, forms, stationary, and other consumables used to support the general administration of the workshop); office equipment (e.g., typewriters, calculators, copy machines, desks, chairs, file cabinets) and the cost of its maintenance; and professional services (e.g., accountants, lawyers, payroll or computer services, general public relations). The aforementioned should not be construed as an all inclusive list; rather, the workshop should carefully examine their organization to determine all personnel and expenses falling within the category of general administration.

Building and Occupancy Costs

Building and occupancy costs, the second major area within overhead, has a number of costs: building rent or mortgage expense, all utility expenses (e.g., heat, light, water, telephone), taxes, building insurance, building maintenance and repairs, building furnishings and equipment (excluding items exclusive to one department and accounted elsewhere, such as production or office equipment, trash and snow removal, landscaping, the cost of any vehicles serving the entire workshop (including drivers, fuel, repairs, and depreciation), but excluding the part assigned as a production expense, and mileage, travel, and business expenses of administrative personnel. Again, the above list should not be regarded as being complete. The workshop should carefully examine their facility to ascertain if any other items should be listed within building and occupancy costs.

CALCULATING OVERHEAD COSTS

The procedure for determining overhead costs is similar to that used for determining indirect costs. Observe the Overhead Cost Calculation Sheet (Figure 9 on page 51). Historical data and the assistance of the workshop bookkeeper or accountant are very helpful for such determinations. This data will involve individual estimates and judgments.

As was the case with indirect costs, a comparison should be made between historical cost data (last fiscal year) and current information. Significant differences should be noted, with adjustments being made accordingly.

Since overhead costs are costs incurred for the entire workshop, it is necessary to determine what portion of each of these expenses should be charged to the production unit.

A. Salaries and Wages (including fringe benefits)

Estimate the percentage of each individual's time which is spent dealing with or performing duties connected with the production unit. Ask the individuals involved to analyze their jobs, and decide what percentage of their time is spent on various functions. Information can also be obtained from the executive director or personnel director, who may have knowledge of the position or a job description listing percentage of time involved in various functions. For example, the executive director may spend 40% of the average day on rehabilitation, 30% on general personnel, 20% on public relations, and 10% on production. If this was the case, 10% of his annual salary (including fringe benefits) would be charged to production overhead. The same procedure would be true for other personnel classified in the overhead category - determine the percentage of their time spent on production and charge that percentage of their annual salary to production overhead.

B. Other Overhead Costs

The remaining costs are usually allocated on a "square footage" basis.

1. Determine the total number of square feet in the facility, including: offices, lunchrooms, work areas, activity areas, loading dock, storage, and all other areas.

2. Calculate the number of square feet the production unit occupies, Include: general work areas, storage, shipping, docks, contract procurement, production office space, and any other area related exclusively to production.

3. Divide the total production area square footage figure by the total workshop square footage figure to determine the percentage (of the workshop) devoted to production.

   Example: $\frac{18,000 \text{ (total production area square feet)}}{40,000 \text{ (total workshop square feet)}}$ = .45 or 45%

   The production areas comprise 45% of the total workshop floor space.

4. Add the overhead costs (building, utilities, insurance, supplies, office equipment, general workshop furnishings and equipment, etc.). Use depreciation methods to determine annual costs. Multiply the total of these overhead costs by the production overhead percentage to obtain the dollar amount to be attributed to production.

5. Add the figure from #4 above to the previously calculated salary figures to arrive at a total annual overhead cost for the production unit.

6. Determine the direct labor cost for the last fiscal year (the same time period the overhead data was obtained from).

7. Divide the total annual production overhead cost by the total annual direct labor cost.

8. Multiply the answer from #7 by 100 to arrive at a percent, overhead allowance.

9. Finally, to determine how much overhead to apply to a specific job, multiply the total projected direct labor cost for the job by the percent of overhead allowance. The answer is the dollar amount of overhead to include within the bid.

   Example:

   All overhead salaries attributed to production = $ 38,000

   Other overhead expenses attributed to production = 79,000

   TOTAL OVERHEAD PRODUCTION = $117,000

   TOTAL DIRECT LABOR = 90,000

   $\frac{\$117,000}{90,000} \times 100$ = 130% Overhead Allowance

Figure 9

OVERHEAD COST CALCULATION SHEET

1. SALARIES & WAGES

Person/Position	Annual Salary (inc. benefits)	% Time Charged to Production Overhead	Annual Salary Applicable to Overhead

TOTAL _____ _____

2. OTHER COSTS

Building	_____
Utilities	_____
Insurance	_____
Supplies	_____
Office Equipment	_____
General Workshop Furnishings and Equipment _____	_____
Other Related Costs	
_____	_____
TOTAL COSTS	_____

(1) Total Square Feet of Facility _____

(2) Total Square Feet of Production Area _____

(3) Percentage of Facility Devoted to Production (2) ÷ (1) _____

Amount of Other Costs Applicable to Overhead (Total Costs x Percentage of Facility Devoted to Production) _____

TOTAL SALARIES, WAGES, AND OTHER COSTS _____

3. DIRECT LABOR COST (same time period as #1 & #2) _____

4. TOTAL ANNUAL OVERHEAD COST (#2 ÷ #3) _____

5. OVERHEAD COST AS A PERCENTAGE (#4 x 100) _____ %

To determine the amount of overhead applied to a specific job:

Projected direct labor cost for job = $12,000

Percent overhead allowance = 130% (1.30)

$12,000
x 130% (1.30)
$15,600 overhead (to be added to direct labor and indirect costs)

SUMMARY

As is the case with indirect costs, careful analysis and consideration is advised for all components of overhead cost calculation. Certain cases may necessitate special attention or deviation from the methods outlined here. Arriving at accurate overhead costs is not easy, but the effort put forth is well worth it in terms of a more accurate bid.

> Whenever possible, calculating specific overhead rates for different jobs is recommended since it is a known factor that rates will vary from item to item. Sheltered workshops, however, generally perform an infinite variety of jobs and usually find that they cannot compute with any real degree of accuracy, the specific overhead rate relating to each job. (U.S. Department of Labor, 1978a, p. 1)

Be sure to transfer Overhead Costs to the Contract/Bid Record Form (Figure 3).

4. PROFIT

The first three components discussed thus far, direct cost, indirect cost, and overhead, represent the workshop's cost for doing the work. But how long would most businesses remain open if they sold their goods and services for their cost only? Workshops must add into any bid an amount for profit.

Although workshops are generally nonprofit organizations, the term nonprofit does not mean no profit. Workshops can make as much money as possible on any contract as long as two conditions are fulfilled: (1) clients are paid fairly for the work they do (following U.S. Department of Labor guidelines), and (2) no one individual or group will benefit from the profits. Workshops must put the profits back into the workshop in the form of capital improvements or additions, staff salary increases, additional staff, equipment, or other proper areas.

Workshops must remain competitive with their bids if they are to obtain work and often this is the factor that determines how much or how little will be made on a job. Profit is usually added to the total cost for the job and is figured as a percentage of total costs. Profit percentages can range from 1% to 2% to 25% or more. Generally, the percentage of profit is "what the market will bear." In other terms, profit may be dependent upon how much the competition is charging or how badly the business in question needs the services of the workshop. Adding a profit factor on to cost data is relatively simple.

For example, add:

Direct costs =	$4,000
Indirect Costs =	1,800
Overhead =	3,800
TOTAL COSTS =	$9,600

Suppose 15% is the profit factor desired by the workshop.

	$9,600
	x 15% (.15)
PROFIT =	$1,440

then, add:

Total Cost =	$ 9,600
Profit =	1,440
TOTAL BID PRICE =	$11,040

The total bid price is for a specified quantity of a product and can be expressed in a number of ways: price per piece, per hundred pieces, per thousand pieces, or a total job price as shown above.

Some rehabilitation personnel feel that it is improper for a workshop to make a profit on work completed by the handicapped. Such misunderstandings can be easily refuted. For example:

(1) clients are being paid fairly,

(2) no individual or group is benefiting from the profits,

(3) the profits allow for staff increases and/or staff additions,

(4) the profits can be used to purchase additional equipment and add new facilities,

(5) the profits can help cover possible losses from unforeseen circumstances on jobs.

Profit, then, allows for the growth of the workshop. Without profit, the workshop is doomed to failure as it will no longer be able to sustain itself and perform its functions adequately as a rehabilitation facility. Include the amount for profit on the Contract Bid Record Form (Figure 3).

The workshop will not have all bids accepted by the contractors. Sometimes the workshop and contractors will have to negotiate on the bid price. If this is the case, you may be questioning why the workshop need bother computing bid prices!

Why? So that the workshop knows how much it would cost them to complete the job. A workshop which does not know its costs for a particular contract could find itself in problems when negotiating a bid price with a contractor. The workshop may, in fact, settle on a price below its costs for completing the work.

Thus far we have discussed the costs which must be included within the bid price; however, there is a group of costs which must not be included. Rather, these costs must be borne by the workshop and finances must be secured elsewhere (e.g. fee for services, Title XX, United Way allocations). These costs are referred to as rehabilitation costs.

REHABILITATION COSTS

Rehabilitation workshops serving individuals with handicapping conditions are at a disadvantage cost wise when compared to industry. The production department incurs many costs that industry seldom encounters and unless the workshop considers these added costs prior to preparing bids, the submitted bids will be overbid. These additional costs are known as rehabilitation costs. Several examples have been included for clarification:

(1) Excessive labor turnover and training costs. Many clients, due to the nature of the rehabilitation process, spend a limited amount of time in the workshop. This results in a higher rate of labor turnover than experienced by industry. Labor turnover is expensive (hiring and training costs). In addition, most workshop clients require more training than a person in industry for the same job. Consequently, workshops spend more to maintain a trained work force than does industry.

(2) Lower productivity and greater supervision, floor space and machinery costs. Workshop clients, overall, produce less than their counterparts in industry. As a result, the workshop must use additional floor space, manpower, and equipment if it is to produce a specific quantity of a product in the same amount of time as industry. Also, because of their lower productivity and greater training needs, clients require more supervision than workers in industry. Floor space, equipment, and supervision cost money and as a result, workshops spend more money in these areas (proportionately) than industry.

(3) Excessive material and supply usage. Clients, due to insufficient training or an inability to perform a task, may damage or use excessive amounts of materials or supplies. Such costs are not encountered in industry to the same extent.

(4) Transportation, combining rehabilitation and production functions, and subsidies. Many workshops provide transportation for their clients. Industry seldom, if ever, incurs this cost. Many workshop supervisors perform rehabilitation work with clients while supervising production work. Such practice is not common in industry, and is an added cost for the workshop. Some workshops guarantee certain clients a minimum rate of pay. When the client's productivity does not warrant that rate of pay, the balance (up to the minimum level) is paid to the client in the form of a subsidy. Again, such practice is not found in industry, and is an added cost for the workshop.

Each of the above is a real cost for most workshops; yet, in most cases, these costs are justifiable because clients are being rehabilitated. But, the production unit should not be expected to absorb these costs. Therefore, if a workshop wishes to remain competitive with industry on the jobs it bids on, it must not include these rehabilitation costs. Consequently, these costs should be separated from production costs and be paid for with rehabilitation monies such as state funding, client service fees, or private contributions.

The problem that exists with rehabilitation costs is not in recognizing their presence, but rather, in determining exactly how to separate them from production costs. One method for doing this is to compare the workshop to industry. Examine industrial turnover rates, training costs, productivity levels, supervision ratios, floor space and equipment usage, material and supply waste, and other factors as outlined. The comparison of costs should yield some hard data in some areas and possibilities or trends in others.

If possible, list the cost differences in figures that would reflect the cost difference for one fiscal year. It is important to note that some costs will be very precise, and others only estimates. The amount of time and effort put into these estimates will be reflected in their accuracy. For example, it has been determined that Company A can do a job for $100,000 while the workshop can do it for $110,000. The difference is the rehabilitation cost and must be made up through grants, fund raising, client fees, etc.

Then, separate the cost differences into two categories. Indirect cost and overhead. For example, supervision would be indirect. The space would be overhead. Total the figures for both categories. The total in both cases will represent an estimate of how much the production unit is spending annually on rehabilitation activities. Where these two totals are subtracted from the total annual expenditures for indirect costs and overhead, the workshop will have arrived at more accurate and competitive bids.

The above is a very simplified explanation of a possible solution to a problem which has been facing workshops for quite a long time. While it is extremely important for all workshops to consider and take into account rehabilitation costs, their accurate calculation is probably the most difficult task facing the individual responsible for bidding on production work. Some workshops have decided that their rehabilitation department is and will be responsible for 15% (or even 20%) of the cost of production departments, even though actual figures have not been calculated. This may not be an accurate indicator of costs, and should be avoided.

Having discussed the factors which establish the bid price, it becomes important to consider variables which may affect the bid price.

CONSIDERATIONS FOR ESTABLISHING BIDS

The following information may provide insight into why some workshops do better than others, and how some workshops obtain more money for the work they do.

The law of supply and demand can effect workshop pricing. If a business does not urgently need a product (low demand), or has a number of sources to turn to for the same type of work that is done by the workshop (high supply), it is less likely to pay a premium price for the work. On the other hand, if the business urgently needs the product (high demand) and has limited sources for obtaining

the work force (low supply), it will likely pay a premium price. Such information can be valuable to the workshop when attempting to determine prices.

The "quality image" of a workshop can determine bid prices. When a workshop has a reputation for turning out good quality work on time, it can demand a better price. A workshop's "quality image" can be improved.

Develop accurate cost data. Be sure of your figures when presenting a bid to a business. Many businessses are impressed by workshops who have accurate cost data and can intelligently discuss all aspects of the job. An inaccurate bid is one which is over or underbid. Perhaps an example of each (overbid and underbid) will help clarify matters:

Example 1: Direct labor costs for a possible contract job have been calculated on the basis that all steps will be completed by the clients, without the assistance of machinery. The bid was submitted to the customer, and subsequently, turned down. Later, workshop personnel discovered that a packaging machine, capable of completing several of the operations, could have reduced direct labor costs by 35%. The cost of the machine, distributed over the life of the job, would have been low. This is clearly a case of <u>overbidding</u> the job. Remember, determine the best method of completing the work prior to submitting the bid to the customer.

Example 2: The workshop submits a bid for a possible contract job, basing labor costs on the results of their time study. The bid was accepted by the customer. Direct labor costs for the contract turned out to be more than anticipated. It was discovered that the time study had failed to include two crucial operations. This was an oversight on the part of the workshop and not the customer. This is a case of <u>underbidding</u> the job.

Remember, the best method of completing the job is not necessarily the one which is completed in the fewest operations.

A secondary effect of an overbid or underbid job can be unfair wages being paid to the clients. Workshops, in the past, have been accused of paying clients an insufficient wage for the type of work they complete. In part, this has been so. Most often this has occured as a result of the workshop underbidding the job, realizing it has done so, and then, paying clients up to the extent that they break-even on the job. This is a violation of the Department of Labor requirements and can result in litigation against the workshop.

Never get into "price wars" with other workshops or businesses. Some businesses may promote such price cutting if they know certain workshops are in need of additional contracts. The workshop will hurt itself and subsidize the business by accepting work below cost.

Deal honestly with business. Businesses respect and appreciate honest, accurate answers concerning workshop capabilities for producing goods as specified and delivering on time. Do not hesitate to say "NO" to a job which cannot be handled.

Carefully examine any work accepted at or near cost because of its "high training value." This can be a valid way of obtaining certain types of work, but it can also lead to a weak financial picture.

Evaluate contracts after they are set up and running. Determine whether actual costs are above, at, or below, what predicted costs had been. If significant differences exist, closely examine the possibility of rebidding the job. If the bid price can be lowered, the customer will save money. This may be a tremendous asset for the workshop as the business may give future jobs to the workshop with little or no hesitation.

Many businesses do not care that workshops are nonprofit and "do good things for people." They want their work done on time at a fair price. Workshops must remember that they are in business and must conduct themselves accordingly.

Don't become a free warehouse for businesses. Schedule materials in and out to coordinate with production. Charge the "going rate" for warehousing and storage after a reasonable amount of time has elapsed.

Know the customer financially. Check credit records on new accounts. Don't carry the customer financially! Refer past due accounts to a collection agency if necessary.

SUMMARY

As you have noticed, the items which may make up the costs of doing a particular contract job can be few or many, depending on the nature and scope of the work. Rehabilitation workshops, in general, are dependent upon contract jobs to maintain their existence. It is only fitting that they do the best job possible when calculating contract costs for any contract. The workshop should not rely solely on this publication for calculating contract costs, but rather use it as one of the tools. Experience is the key to developing accurate bids. Use this publication as part of your initial thinking process but widen your horizons as you continue to learn. Good luck! May you continue to profit from your endeavors.

CONTRACT BID EXAMPLE

The following example has been provided to more specifically show the interrelationships that exist among the elements which enter into the determination of the contract bid. The example will include the following:

(1) All information necessary to determining the contract bid price.

(2) Certain mathematical computations which could be confusing to the reader.

(3) Additional information (based on the example) which may assist the reader in understanding the example.

(4) Completed forms based on the information received and computations completed.

With the completion of the example, the reader should have a better grasp of the elements which enter into the establishment of a contract bid.

BACKGROUND:

The EXCEL Company, Inc., a local business, has contacted Workshop A and would like them to submit a contract bid on an assembly and packaging job. They do not have the time nor space available to continue processing the job. The job will have an initial run, with future runs continuing for the next five to seven years. Some of the materials required for the job will be supplied by them, with the remaining materials purchased directly by the chosen bidder. The EXCEL Company, Inc., has prepared a list of all materials required for the job and has designated those that need to be supplied by the bidder. They have included other information pertinent to completing the job. The EXCEL Company, Inc., has done the work themselves in the past, and have been able to provide information concerning the specific job tasks. Refer to pages 62 and 63 for the letter of request for submitting a bid and other information.

After receiving the letter from The EXCEL Company, Inc., Workshop A was able to determine the following facts regarding the job:

(1) All transportation expenses are the responsibility of the bidder.

(2) As the workshop does not own any air wrenches, they would need to purchase or rent them.

(3) An air system would need to be installed within the work area to operate the air wrenches.

(4) A plastic wrap packaging machine would need to be purchased or rented.

(5) Two twenty volt electrical wiring would need to be installed for the machine to function.

(6) The bidder would be required to purchase 1,200 cardboard containers, 3,600 3-inch staples, and 4,800 feet of 3-inch gummed, reinforced tape.

(7) The bidder would need to supply 12 pallets for shipment of the completed products back to the company's warehouse.

Workshop A determined that they had sufficient information with which to procede with the determination of a bid price for the assembly and packaging hardware job. Thus far, the workshop had (1) received written specifications from The EXCEL Company, Inc., and (2) determined that they could complete the work as required. The latter fact was based primarily on the workshop having completed similar assembly jobs.

With the information and the twenty-five packaged units supplied by the company, the workshop proceeded to determine the best method capable of being completed by the clients of the workshop. The Operational Method Summary Sheet on page 64 of this example describes the tasks required for completing the work and is in part derived from the information received from The EXCEL Company, Inc.

Workshop A prepared a schematic diagram of the proposed work flow to assist in determining the amount of floor space required for the job and the location of workbenches, machinery, conveyor belt, electrical wiring, and air system. Page 65 has been provided to show the job setup selected by the workshop.

With an operational method selected, the workshop completed a time study on each of the operations. So as to maintain a written record for their files, they recorded their findings on the Time Study Observation Sheet, found on pages 66, 68, and 70. They disassembled the twenty-five packaged units received from the company and used them to perform the time study. Being a relatively simple job, they elected to time study the operations three separate times. Had the job been more intricate or delicate, they would have increased the number of timings. The workshop eliminated the task involving the machine packaging of the assembled units since they did not currently own such a machine. However, they contacted a company which sold the machine and determined the number of pieces the machine could package per hour. To complete the other operational steps, the workshop used three nonhandicapped staff members. So as to obtain an accurate time study, the workshop allowed the staff sufficient time to learn the tasks. Each staff member was to complete operational steps 1, 2, 4, and 5. This would result in three timings for each of the operational steps. Each staff member was given an operator performance rating by the time study person. This percentage appears in the lower left corner of the Time Study Observation Sheet. Observe the Time Study Observation Sheet for each of the three staff members.

For elements (or steps) #1 and #2, each of the three staff members assembled ten individual units. Average times were obtained by adding the ten cycles and then dividing by ten. Average times obtained for Step #1 were: .42 minute, .44 minute, and .40 minute. Workshop A used a decimal minute stopwatch which was graduated in hundredths of a minute rather than a stopwatch which gave readings in seconds or fractions of seconds. A production time-rate chart has been provided on pages 72-74 and relates decimal minutes to pieces per 60 minute and 50 minute hours and to seconds.

Step #3, machine packaging, was not completed by the staff as the workshop did not own such a machine. However, they were able to obtain information from a company which sold the machine. They were informed that the machine could produce 1,000 pieces per 60 minute hour. By using their production time-rate chart, the workshop noted that each piece required .06 decimal minutes for packaging.

Step #4, rather than being time studied for the length of time to place one completed unit into the cardboard container, was studied for the amount of time required to place twenty five completed units into the container (the number required to complete one container). This step was performed for ten cycles. Average times obtained by the three staff members were: .50 minute, .52 minute, and .48 minute. As costs for this job are to be calculated on the cost per unit (or piece), the workshop will need to determine the time to pack one completed unit into the cardboard container. To do this, the average time for Step #4 must be divided by twenty five to obtain average time per completed unit.

Step #5 is based on the length of time required to seal and stack one container and then bottom staple an empty container for operator position #4. Once again, as the container holds twenty five individual units, the average time for Step #5 must be divided by twenty five to obtain the individual unit (or piece) time. This step was performed for ten cycles. Average times obtained by each of the three staff members were: .75 minute, .78 minute, and .73 minute.

Computations related to each of the operational step time studies have been provided on pages 67, 69, and 71 so that the reader will be able to see the process with little difficulty.

The EXCEL Company, Inc.
3109 Industrial Lane
Menomonie, WI 54751
Tel. No. (715) 239-6153

July 6, 1980

Thor Olsen
Contract Director
Workshop A
1120 Ballantine
Menomonie, WI 54751

Dear Mr. Olsen:

The EXCEL Company, Inc., will welcome the submittance of a contract bid from your workshop for an assembly and packaging job. As our customers are awaiting the finished product, we must ask that you return your bid to our address no later than 4:00 p.m. on July 13, 1980. Acceptance or rejection of your bid should be known to you on or before August 3, 1980. Page two of this letter indicates all information relative to the job. If you have any further questions, please telephone me at our company number.

Respectfully,

Olaf Swenson

Olaf Swenson
Production Manager

OHS: dcm

Job:	Assembly and Packaging Hardware
Quantity:	30,000
Expected Arrival Date:	August 16, 1980
Completion Date:	On or before August 28, 1980
Description of Job:	Hand assemble together three different pieces of hardware using four hex-nuts, bolts, and lock washers. Tighten bolts and nuts to thirty pounds of pressure with an air wrench. Plastic wrap each completed unit by packaging machine. Place twenty-five packaged units in cardboard container. Container bottom must be sealed with three 3-inch staples. Container top must be sealed with four feet of 3" gummed, reinforced tape. Plastic band one hundred containers per pallet.
Quality Requirements:	Packaged units must be free of dust particles inside and outside of wrap. Nuts and bolts must be tightened to thirty pounds of pressure.
Shipping/Receiving:	All materials supplied by The EXCEL Company, Inc., must be picked up by the bidder at the company's warehouse (121 N. Main Street, Menomonie, WI 54751). Completed product must be returned to same location.
Materials/Equipment:	The EXCEL Company, Inc., will supply: Hardware Piece A - 30,000 pieces Hardware Piece B - 30,000 pieces Hardware Piece C - 30,000 pieces Hex-Nuts -120,000 pieces Bolts -120,000 pieces Lock Washers -120,000 pieces The Bidder must supply: Plastic Wrap Packaging Machine Plastic Wrap Cardboard Containers (2 ft. x 2 ft. x 2 ft.) 3-inch staples Gummed, reinforced tape (3 inches wide) Pallets Air Wrenches Any other materials or equipment required to complete the job.

Twenty-five packaged units have been provided to indicate to the bidder what is involved with the job, and to assist them with the completion of their time study and subsequent bid.

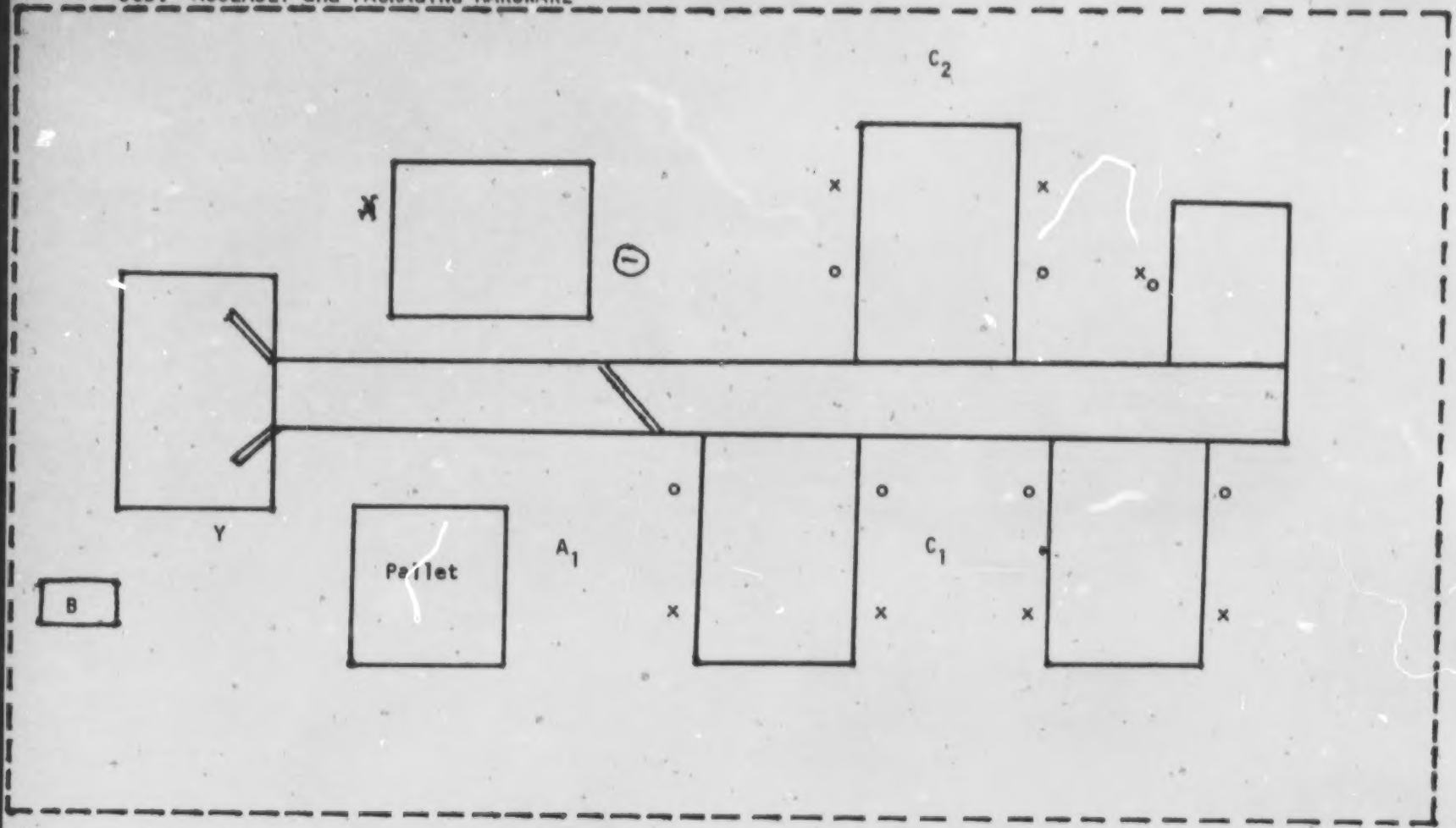
Workshop A
Operation Method Summary Sheet

Element Breakdown

Identification of Operation:	The EXCEL Company, Inc. Assembly and Packaging Hardware	Date: July 8, 1980

Element No.	Element Description
1.	Operator Position #1: Assembly Reach for hardware A (1 pc.) and hardware B (1 pc.). Join hardware A and B so that bolt holes match. Reach for 2 bolts (place into 2 holes on hardware A and through hardware B). Reach for 2 lockwashers (place 1 washer on each bolt). Reach for 2 hex-nuts (place 1 nut on each bolt and screw ¼ inch). Tighten nuts with air wrench. Return to conveyor belt.
2.	Operator Position #2: Assembly Reach for partially assembled unit from conveyor belt. Reach for hardware C (1 pc.). Join hardware C to hardware A side so that bolt holes match. Reach for 2 bolts (place into 2 holes on hardware C and through hardware A). Reach for 2 lockwashers (place 1 washer on each bolt). Reach for 2 hex-nuts (place 1 nut on each bolt and screw ¼ inch). Tighten nuts with air wrench. Return to conveyor belt.
3.	Operator Position #3: Machine Packaging Reach for assembled unit from conveyor belt. Place assembled unit into packaging machine (press foot-operated pedal).
4.	Operator Position #4: Container Packer Reach for empty container with bottom stapled. Reach for packaged unit from conveyor belt (place 25 units into container). Set container with 25 units to side (repeat operation).
5.	Operator Position #5: Sealer/Stacker/Container Assembler Reach for container with 25 units (remove 4 feet of gummed, reinforced tape from automatic tape dispenser). Tape top of container. Set taped container on pallet (100 containers per pallet). Repeat process. When time available, assemble containers for operator position #4 (open unassembled container and operate foot-controlled box stapler to place three 3 inch staples in container bottom).
	Work materials to be supplied by the workshop material handler. Pallets to be transferred to shipping area by material handler.

JOB: ASSEMBLY and PACKAGING HARDWARE



65

66

A_1 to A_2 = air system
C_1 to C_2 = air system
B = box stapler
X = 220 volt plug

T joint at point C_1

¼ inch = 1 foot
x = step 1
o = step 2
⊖ = step 3
Y = step 4 and 5
xo = step 1 and 2

67

Workshop A
Time Study Observation Sheet

Identification of Operation:	The EXCEL Company, Inc. Assembly and Packaging Hardware		Date: July 8, 1980
Began Timing: Ended Timing:	Operator: Staff #1	Approval:	Observer: Thor Olsen

	Element Description and (breakpoint).		Cycles 1	2	3	4	5	6	7	8	9	10	Avg. Time ea. Element
1.	Assemble hardware pieces A and B	T	.42	.44	.40	.45	.41	.40	.42	.41	.40	.45	.42
		R											
2.	Assemble hardware piece C to element #1	T	.45	.44	.42	.43	.40	.40	.38	.41	.38	.39	.41
		R											
3.	Package assembled units with machine	T											.06*
		R											
4.	Pack 25 packaged units per container	T	.50	.51	.52	.48	.49	.48	.48	.51	.52	.51	.50**
		R											
5.	Seal and stack one container, prepare one container for #4	T	.83	.76	.71	.74	.70	.74	.76	.71	.78	.77	.75**
		R											
6.		T											
		R											
7.		T											
		R											
8.		T											
		R											
9.		T											
		R											
10.		T											
		R											

Operator Performance Rating: 95 %

Foreign Elements: None

* Operator performance rating = 100%

** .50 and .75 represent times for 25 completed units and need to be changed to average time per one unit.

Staff #1

Step	1	2	3	4*	5*	
	.42	.45	.06	.50	.83	* individual times represent completion of 25 units
	.44	.44	.06	.51	.76	
	.40	.42	.06	.52	.71	
	.45	.43	.06	.48	.74	
"add"	.41	.40	.06	.49	.70	
	.40	.40	.06	.48	.74	
	.42	.38	.06	.48	.76	
	.41	.41	.06	.51	.71	
	.40	.38	.06	.52	.78	
	.45	.39	.06	.51	.77	
	4.20	4.10	.60	5.00	7.50	
"average time per unit"	4.20 ÷ 10	4.10 ÷ 10	.60 ÷ 10	5.00 ÷ 10	7.50 ÷ 10	
	.42	.41	.06	.50 ÷ 25	.75 ÷ 25	
				.02	.03	
"operator performance rating"	95%	95%	100%	95%	95%	
"adjusted average time per unit"	.42 x 95%	.41 x 95%	.06 x 100%	.02 x 95%	.03 x 95%	
	.399	.390	.06	.019	.0285	

"total adjusted average time per unit" .399 + .390 + .06 + .019 + .0285 = .8965

Workshop A
Time Study Observation Sheet

Identification of Operation:	The EXCEL Company, Inc. Assembly and Packaging Hardware	Date: July 8, 1980

Began Timing: Ended Timing:	Operator: Staff #2	Approval:	Observer: Thor Olsen

	Element Description and (breakpoint).		Cycles 1	2	3	4	5	6	7	8	9	10	Avg. Time ea. Element
1.	Assemble hardware pieces A and B	T	.46	.43	.44	.42	.40	.43	.44	.45	.43	.50	.44
		R											
2.	Assemble hardware piece C to element #1	T	.46	.48	.43	.42	.40	.42	.46	.45	.40	.38	.43
		R											
3.	Package assembled units with machine	T											.06*
		R											
4.	Pack 25 packaged units per container	T	.53	.50	.51	.51	.53	.52	.53	.52	.52	.53	.52**
		R											
5.	Seal and stack one container, prepare one container for #4	T	.82	.80	.76	.79	.75	.78	.77	.79	.74	.80	.78**
		R											
6.		T											
		R											
7.		T											
		R											
8.		T											
		R											
9.		T											
		R											
10.		T											
		R											

Operator Performance Rating: 90 %

Foreign Elements: None

* Operator performance rating = 100%

** .52 and .78 represent times for 25 completed units and need to be changed to average time per one unit.

Staff #2

Step	1	2	3	4*	5*	
	.46	.46	.06	.53	.82	*individual times represent completion of 25 units
	.43	.48	.06	.50	.80	
	.44	.43	.06	.51	.76	
	.42	.42	.06	.51	.79	
"add"	.40	.40	.06	.53	.75	
	.43	.42	.06	.52	.78	
	.44	.46	.06	.53	.77	
	.45	.45	.06	.52	.79	
	.43	.40	.06	.52	.74	
	.50	.38	.06	.53	.80	
	4.40	4.30	.60	5.20	7.80	
"average time per unit"	4.40 ÷ 10	4.30 ÷ 10	.60 ÷ 10	5.20 ÷ 10	7.80 ÷ 10	
	.44	.43	.06	.52 ÷ 25	.78 ÷ 25	
				.0208	.0312	
"operator performance rating"	90%	90%	100%	90%	90%	
"adjusted average time per unit"	.44 x 90%	.43 x 90%	.06 x 100%	.0208 x 90%	.0312 x 90%	
	.396	.387	.06	.01872	.02808	

"total adjusted average time per unit" .396 + .387 + .06 + .01872 + .02808 = .8898

Workshop A
Time Study Observation Sheet

Identification of Operation:	The EXCEL Company, Inc. Assembly and Packaging Hardware	Date: July 8, 1980	
Began Timing: Ended Timing:	Operator: Staff #3	Approval:	Observer: Thor Olsen

	Element Description and (breakpoint).		Cycles 1	2	3	4	5	6	7	8	9	10	Avg. Time ea. Element
1.	Assemble hardware pieces A and B	T	.43	.43	.41	.40	.37	.38	.37	.39	.43	.39	.40
		R											
2.	Assemble hardware piece C to element #1	T	.44	.46	.42	.40	.41	.40	.43	.42	.41	.41	.42
		R											
3.	Package assembled units with machine	T											.06*
		R											
4.	Pack 25 packaged units per container	T	.50	.51	.49	.47	.48	.48	.47	.46	.47	.47	.48**
		R											
5.	Seal and stack one container, prepare one container for #4	T	.79	.75	.71	.70	.74	.75	.71	.71	.72	.72	.73**
		R											
6.		T											
		R											
7.		T											
		R											
8.		T											
		R											
9.		T											
		R											
10.		T											
		R											

Operator Performance Rating: 95 %

Foreign Elements: None

* Operator performance rating = 100%

** .48 and .73 represent times for 25 completed units and need to be changed to average time per one unit.

Staff #3

Step	1	2	3	4*	5*	
	.43	.44	.06	.50	.79	* individual times represent completion of 25 units
	.43	.46	.06	.51	.75	
	.41	.42	.06	.49	.71	
"add"	.40	.40	.06	.47	.70	
	.37	.41	.06	.48	.74	
	.38	.40	.06	.48	.75	
	.37	.43	.06	.47	.71	
	.39	.42	.06	.46	.71	
	.43	.41	.06	.47	.72	
	.39	.41	.06	.47	.72	
	4.00	4.20	.60	4.80	7.30	
"average time per unit"	4.00 ÷ 10 = .40	4.20 ÷ 10 = .42	.60 ÷ 10 = .06	4.80 ÷ 10 = .48 ÷ 25 = .0192	7.30 ÷ 10 = .73 ÷ 25 = .0292	
"operator performance rating"	95%	95%	100%	95%	95%	
"adjusted average time per unit"	.40 x 95% = .38	.42 x 95% = .399	.06 x 100% = .06	.0192 x 95% = .01824	.0292 x 95% = .02774	

"total adjusted average time per unit" .38 + .399 + .06 + .01824 + .02774 = .88498

Production Time-Rate Chart

Dec. Min	Pcs./60 Min. Hr.	Pcs./50 Min. Hr.	Seconds
.01	6000	5000	.6
.02	3000	2500	1.2
.03	2000	1666	1.8
.04	1500	1250	2.4
.05	1200	1000	3.0
.06	1000	833	3.6
.07	858	714	4.2
.08	750	625	4.8
.09	666	555	5.4
.10	600	500	6.0
.11	545	454	6.6
.12	500	416	7.2
.13	462	384	7.8
.14	428	357	8.4
.15	400	333	9.0
.16	375	312	9.6
.17	353	294	10.2
.18	333	277	10.8
.19	316	263	11.4
.20	300	250	12.0
.21	286	238	12.6
.22	273	227	13.2
.23	261	217	13.8
.24	250	208	14.4
.25	240	200	15.0
.26	231	192	15.6
.27	222	185	16.2
.28	214	178	16.8
.29	207	172	17.4
.30	200	166	18.0
.31	194	161	18.6
.32	188	156	19.2
.33	182	151	19.8
.34	176	147	20.4
.35	171	142	21.0
.36	167	138	21.6
.37	162	135	22.2
.38	158	131	22.8
.39	154	128	23.4
.40	150	125	24.0
.41	146	121	24.6
.42	143	119	25.2
.43	140	116	25.8
.44	136	113	26.4
.45	133	111	27.0
.46	130	108	27.6

(continued)

Production Time-Rate Chart

Dec. Min	Pcs./60 Min. Hr.	Pcs./50 Min. Hr.	Seconds
.47	128	106	28.2
.48	125	104	28.8
.49	122	102	29.4
.50	120	100	30.0
.51	118	98	30.6
.52	115	96	31.2
.53	113	94	31.8
.54	111	92	32.4
.55	109	90	33.0
.56	107	89	33.6
.57	105	87	34.2
.58	103	86	34.8
.59	102	84	35.4
.60	100	83	36.0
.61	98	81	36.6
.62	97	80	37.2
.63	95	79	37.8
.64	94	78	38.4
.65	92	76	39.0
.66	91	75	39.6
.67	90	74	40.2
.68	88	73	40.8
.69	87	72	41.4
.70	86	71	42.0
.71	85	70	42.6
.72	83	69	43.2
.73	82	68	43.8
.74	81	67	44.4
.75	80	66	45.0
.76	79	65	45.6
.77	78	64	46.2
.78	77	64	46.8
.79	76	63	47.4
.80	75	62	48.0
.81	74	61	48.6
.82	73	60	49.2
.83	72	60	49.8
.84	71	59	50.4
.85	70	58	51.0
.86	69	58	51.6
.87	68	57	52.2
.88	68	56	52.8
.89	67	56	53.4
.90	66	55	54.0
.91	65	54	54.6
.92	65	54	55.2

(continued)

Production Time-Rate Chart

Dec. Min.	Pcs./60 Min. Hr.	Pcs./50 Min. Hr.	Seconds
.93	64	53	55.8
.94	63	53	56.4
.95	63	52	57.0
.96	62	52	57.6
.97	61	51	58.2
.98	61	51	58.8
.99	60	50	59.4
1.00	60	50	60.0

Pieces per 60 minute and 50 minute hours have been presented in the table in whole numbers. Fractions of pieces has been dropped.

When the total average adjusted time for each of the three staff members are added together and divided by three, an average adjusted nonhandicapped time is obtained. Workshop A will use this time for determining the number of units which can be completed by the nonhandicapped person. Computations are as follows:

Total average adjusted time for completion of one unit:

Staff #1	-	.8965 decimal minute
Staff #2	-	.8898 decimal minute
Staff #3	-	.88498 decimal minute
TOTAL	-	2.67128 decimal minute ÷ 3 = .890427 decimal minute

Thus, Workshop A has determined that it takes an average of .890427 decimal minute to complete steps 1, 2, 3, 4, and 5 (for a nonhandicapped person).

Observe the production time-rate chart on pages 72-74. Find the column for decimal minutes and go down it until you locate .890427 decimal minute. This number is very close to .89 decimal minute and will be used for our purposes. If you look across from .89 decimal minute, you will observe three additional numbers. The first number (67) refers to the pieces which can be completed in a sixty-minute work hour by a nonhandicapped person. This means that the worker would work the entire sixty minutes without any breaks or interruptions. The second number (56) refers to the pieces which can be completed in a fifty-minute work hour. This means that the worker would be working for fifty minutes out of every hour. The remaining ten minutes is consumed by break time, downtime, or other interruptions. The third number (53.4) refers to the number of seconds. This number has been provided so that workshops not utilizing a decimal stop-watch may be able to convert times from seconds to decimal minutes. Workshop A has decided to compute their costs for the job based on the fifty-minute work hour.

DETERMINING CLIENT NUMBERS AND PRODUCTION OUTPUT FOR THE JOB:

From the time study results, it has been calculated that a nonhandicapped person will complete 56 pieces during every fifty-minute work hour, provided all five steps are completed. It is highly improbable that one person would complete every step - the job would most likely be set up in an assembly line fashion. However, to determine the number of clients required to complete the job within a given period of time, total pieces per hour will suffice.

First, determine the workshop's performance level. Workshop A was able to determine that their clients, overall, averaged 64% (percent) of competitive standards. Therefore, the clients could not be expected to complete 56 pieces per hour (doing the entire job). Rather, they would complete 64% of the 56 pieces for every hour they worked, or 35.84 pieces (56 x 64% = 35.84).

If the job order calls for the completion of 30,000 units (or pieces), then 837+ man hours will be required to complete the job (30,000 units ÷ 35.84 units per hour = 837 + man-hours). If the workshop operates on a six and one-half man-hour day for clients, then 128.77 man-hour days will be required to complete the job (837 + man-hours ÷ 6.5 man-hour days = 128.77 man-hour days). If the workshop wishes to complete the work in approximately nine days (they have a maximum of ten days), they will need 14.308 clients who as a group average 64%

of nonhandicapped productivity level (128.77 man-hour days ÷ 9 days for completion = 14.308 clients). Workshop A decided to use 15 clients for the job. As such, they knew that they should be able to complete the job in 8.59 days (15 clients x 35.84 pc./hr. = 537.6 pc./hr.; 537.6 pc./hr. x 6.5 hr./day = 3494.4 pc./day; 30,000 total pc. ÷ 3494.4 pc./day = 8.59 days).

By deciding to complete the work ahead of schedule, the workshop has allowed approximately one and one-half days for any unexpected problems which may occur (e.g., machine breakdown, air system problems, or facility shutdown due to severe weather, all of which would extend the time required to complete the job).

DETERMINING THE NUMBER OF CLIENTS REQUIRED FOR EACH STEP OF THE OPERATION

Workshop A knew that the clients in their workshop averaged 64% of competitive standards as far as productivity was concerned. The workshop wanted to assign enough clients in every step to assure that there would be a smooth work flow among each of the steps. As the machine operation step (#3) could only be completed by one client, production outputs for the other four steps was based on production output for Step #3. Workshop A had learned that the plastic wrap packaging machine could produce 1,000 pieces during every sixty minutes of production time. The workshop, however, intended to use the machine for fifty minutes of every hour. Thus, they examined the production time-rate chart and noted that 833 pieces could be completed during a fifty-minute work hour, or one piece every decimal minute. A client capable of operating the machine at 64% of competitive standards could produce 533.12 pieces per fifty-minute hour (833 pc. x 64% = 533.12 pc.)

Therefore, Steps 1, 2, 4, and 5 must complete 533.12 pc./hour to maintain the production output capable with Step #3. Before determining the number of clients necessary for each of the steps, average nonhandicapped units per fifty-minute hour for each step must be calculated:

(1) Add the average adjusted times for each of the three staff members for each of the four remaining steps.

(2) Divide each of the totals by three to obtain an average adjusted time for each of the four steps.

(3) Observe the pieces/fifty-minute hour which correspond to the average adjusted time for each of the four steps (on the production time-rate chart). The number of pieces arrived at for each of the four steps refers to the number of pieces which can be completed by a nonhandicapped person during every fifty minutes of work hour.

Step	1	2	4	5
Staff #1	.399	.390	.019	.0285
Staff #2	.396	.387	.01872	.02808
Staff #3	.380	.399	.01824	.02774
TOTAL	1.175	1.176	.05596	.08432
÷	3	3	3	3
Average	.3916	.392	.018653	.028107
pc./50 min. hour	128	128	2,700	1,775

Then, to determine the number of pieces which can be completed by clients performing at 64% of competitive standards, multiply the nonhandicapped pieces per 50 minute hour by 64%. The number of clients required for each of the first two steps is arrived at by dividing 533.12 pieces (Step 3) by the number of pieces which can be completed by a client (at 64%) for each of the two steps. Calculations are as follows:

Pieces/fifty minute hour	128	128
x	64%	64%
Client/pieces/hour	81.92	81.92

Since Steps 1 and 2 provide work for Step 3, and Step 3 is to maintain an output level of 533.12 pieces/50 minute hour, then 6.5 clients will be needed for each of the two steps in order to produce 533.12 pieces per fifty minute hour (533.12 pieces ÷ 81.92 pieces = 6.5). Thus, total number of clients assigned to steps 1 and 2 equals thirteen. The workshop has the option of assigning 6.5 clients to each of the steps. Of course, one client would then be responsible for completion of both steps. Or, the workshop has the option of using statistics to their liking. They could opt to place five of the faster clients on Step 1 and eight slower clients on Step 2. Here they are indicating that the five clients in Step 1 can supply all of the work that the eight clients in Step 2 are capable of handling. What the workshop will want to do is maintain a smooth flow of work from step to step. This means that each step must complete 532.48 pieces during every fifty minute work hour.

Steps 4 and 5 are also responsible for completing 532.48 pieces per fifty minute work hour. The workshop wants to select a client which is capable of completing this amount, but who will not be idle for any great amount of time. They completed some mathematical computations to determine the productivity level of the client to be selected to complete Steps 4 and 5 of the job. The computations are as follows:

Steps 4 and 5:	532.48	pieces per fifty minute hour
	÷	
	25	pieces per container
	21.29	containers per fifty minute hour

The nonhandicapped rate for number of containers that can be completed in a fifty minute hour for steps 4 and 5 are:

Step 4: 2,700 pieces ÷ 25 pc./container = 108 containers
Step 5: 1,775 pieces ÷ 25 pc./container = 71 containers

(x) = percent of competitive standards expressed in decimal amount

Thus,

$$\frac{21.29}{(x)\ (108)} + \frac{21.29}{(x)\ (71)} = 1 \text{ (or 100\% - nonhandicapped productivity rate)}$$

To isolate (x), remove 108 and 71. To do this, multiply together 108 and 71 to obtain a common number (108 x 71 = 7,668).

Then, $\left(\frac{7,668}{1}\right)\left(\frac{21.29}{(x)\ (108)}\right) + \left(\frac{7,668}{1}\right)\left(\frac{21.29}{(x)\ (71)}\right) = (1)\ (7,668)$

Reduce to lowest fractions possible:

$$\left(\frac{7,668}{1}\right)\left(\frac{21.29}{(x)\ (108)}\right) + \left(\frac{7,668}{1}\right)\left(\frac{21.29}{(x)\ (71)}\right) = (1)\ (7,668)$$

Combine like fractions: $\frac{(71)\ (21.29)}{(1)\ \ (x)} + \frac{(108)\ (21.29)}{(1)\ \ (x)} = 7,668$

Simplify: $\frac{1511.29}{(x)} + \frac{2299.32}{(x)} = 7,668$

Add: $\frac{3810.91}{(x)} = 7,668$

To isolate (x), multiply both sides by $\frac{(x)}{1}$; then, divide both sides by $\frac{1}{7,668}$.

$$\frac{3810.91}{7,668} = (x)$$

(x) = .4969 or 49.69%

Thus, if a client whose productivity level was 49.69% of competitive standards, he or she would then work exactly fifty minutes of every work hour. The workshop will not want to place anyone whose level falls below 49.69% as that individual would not be able to handle all work from Step 3. Thus, the workshop will want to assign Steps 4 and 5 to a client whose level of productivity is at or slightly above 49 69%.

COSTS ASSOCIATED WITH SETTING UP THE JOB SITE

Workshop A prepared a list of the costs which would be incurred as a result of setting up the assembly and packaging job. They did no actual work because

they did not know if their bid would be accepted by the company. The types and amounts of costs are as follows:

(1) Approximately 800 square feet will be required for the operation of the job (see schematic diagram for layout).

(2) The job will be set up in the northwest corner of the workshop as jobs throughout the remainder of the facility raise dust and other particles.

(3) Equipment on hand include: box stapler, conveyor belt, all tables and chairs. Labor costs associated with moving these items into the area of the workshop and the configuration in the schematic diagram are estimated to be $125.00. A ten percent allowance factor was added.

(4) Workshop A will need to purchase or rent a plastic wrap packaging machine and thirteen air wrenches. They chose to purchase the equipment if they received the bid. Workshop A had located a company which sold the packaging machine, and was informed that they would set up the machine for $150.00. If the workshop chose to hire someone else to set the machine up, or do it themselves, the company would not guarantee the efficiency of the machine. Thus, Workshop A decided to go with the bid for setting up the machine from the company selling it. Workshop A included an allowance factor of 10% to the machine setup. The setup charge included freight expense from the company's warehouse.

(5) A 220 volt electrical line and plug will need to be installed for the machine to operate. Costs involved include: electrician's labor for the wiring and materials. Three bids were obtained ($100, $145, and $120). A ten percent allowance factor was added for any modifications which would be required once the actual job was started. As the low bid of $100 met the standards required by the workshop, it was chosen.

(6) A compressed air line system will need to be installed for the operation of the air wrenches. Costs involved include: labor for the installation of the compressed air system, the materials required for the system, and thirteen air lines from the system to the air wrenches. Approximately thirty feet of the system will be required for points A1 to A2. C1 and C2 will require approximately thirteen feet of air system. Three bid estimates were received for the work ($580, $515, and $625). The workshop added an allowance factor of 15% for any modifications required during the operation of the job. The bid for $515 met the requirements of the workshop.

Workshop A recorded pertinent information relative to setting up the job on the Job Setup Specification Sheet (page 80). They recorded bids relating to setup costs on their cost sheet (page 81). They arrived at a total job setup cost of $1,004.25. Rounding the amount to $1,005, they recorded this on the contract bid record (page 82). Observe A1 which pertains to job setup.

Figure 2A

JOB SETUP SPECIFICATION SHEET

1. Job Title: Assembly and Packaging Hardware

2. Floor Space Required: 800 square feet

3. Cleanliness/Climate Requirements:

   Free from dust and other particles. Plastic wrap must not be soiled in any manner.

4. Equipment Required:

   A. On-Hand:
      Box stapler, banding tools, tape dispenser

   B. To Be Purchased:
      Plastic wrap packaging machine
      Thirteen air wrenches

5. Equipment Requiring Relocation (including freight/moving expenses):

   Five tables, thirteen chairs, box stapler, tape dispenser, conveyor belt

6. Electrical Wiring Requirements:

   220 volt wire for machine - fifty feet of wire, three-prong plug, wiring to main box

7. Plumbing/Hydraulic/Air Systems Required:

   Approximately forty-three feet of compressed air line required. This will be annexed to current air system. New system will have a T-joint intersection at point C1. Materials and labor by bid.

8. Other Factors Required:
   In-house equipment including conveyor, table, chairs, box stapler, and tape dispenser must be set up according to schematic layout.

Figure 2B

1. Job Setup

Description	Bids/Estimates #1	#2	#3	Allowance Factor (for modifications)	Adjusted Cost of Setup
1. Plastic wrap packaging machine	$150	-	-	10% ($15)	$165
2. Electrical wiring for machine, labor, and materials	$100	$145	$120	10% (10)	$110
3. Compressed Air System, labor, and materials	$580	$515	$625	15% ($77\frac{25}{}$)	$592\frac{25}{}$
4. Set up of equipment on hand in facility	$125	-	-	10% ($12\frac{50}{}$)	$137\frac{50}{}$
5.					
6.					
7.					
8.					
9.					
10.					
TOTAL					$1,004\frac{75}{}$

Figure 3

CONTRACT BID RECORD

JOB	Assembly and Packaging Hardware	WORKSHOP CONTRACT NO.	7314
CUSTOMER	The EXCEL Company	DATE BID PREPARED	July 10, 1980
ADDRESS	3109 Industrial Lane	DATE BID SUBMITTED	July 12, 1980
	Menomonie, WI 54751	DATE BID ACCEPTED	August 1, 1980
		DATE BID REJECTED	-
TELEPHONE NO.	(715) 239-6153		
CONTACT PERSON	Olaf Swenson	PERSON PREPARING BID	Thor Olsen
TITLE	Production Manager		

DESCRIPTION OF JOB: Assemble three different pieces into one completed unit. Nuts, bolts, washers, hand assembled, then tightened with air wrench. Assembled unit placed in plastic wrap packaging machine. Remove packaged unit. Place 25 units in cardboard container, bottom stapled with 3-inch staples, top sealed with gummed, reinforced tape. Plastic band 100 containers per pallet for shipping to the EXCEL Comapny.

TOTAL COSTS

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A. DIRECT COSTS

1.	job setup	$1,005.00
2.	direct labor	2,624.00
3.	direct materials	523.00
4.	freight	24.00
5.	machinery and equipment	163.00
	TOTAL	$4,339.00

B. INDIRECT COSTS

1.	percentage amount applied	143 %
2.	total of direct labor cost (see A.)	$2,624.00
	TOTAL INDIRECT COST (#1 x #2)	$3,752.00

C. OVERHEAD

1.	percentage amount applied	50 %
2.	total direct labor cost (see A.)	$2,624.00
	TOTAL OVERHEAD COST (#1 x #2)	$1,312.00

D. PROFIT

1.	Direct Cost	$4,339.00	
2.	Indirect Cost	3,752.00	
3.	Overhead	1,312.00	
	Total Costs		$9,403.00
	percentage of profit		15 %
	Profit on Job (total costs x % profit)		$1,410.00

85

BID PRICE

A.	Direct Cost	$4,339.00
B.	Indirect Cost	3,752.00
C.	Overhead	1,312.00
D.	Profit	1,410.00
	TOTAL	$10,813.00

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DETERMINING DIRECT LABOR COSTS

The direct labor cost computation sheet (page 84) will be used to record information necessary for determining direct labor costs. Notcie that Workshop A recorded each operational step, time study averages for each step and each staff member, average time for each step, performance rating (an average of 95%, 95%, and 90%) of 93%, normal time, commensurate hourly wage, pieces per hour, and cost per piece. The commensurate hourly wage rate for each of the steps was determined by checking with their job analyst at the state employment bureau. Cost per piece was arrived at by dividing commensurate hourly wage by pieces per hour. Total cost per piece was arrived at by adding together cost per piece for each step.

Workshop A had to compute fringe benefit cost before being completed with direct labor costs. They had a percentage rate of 5.4%, but they decided that they should update the figure. It had been over one year since they had computed fringe benefit cost. To obtain the percentage figure, they obtained new figures from their bookkeeper. Their bookkeeper informed them that during the previous year, $9,000 was paid for client fringe benefits. This amount was the result of social security contributions, vacation and sick leave for clients themselves. The bookkeeper also determined that $125,000.00 was paid to the clients for wages during the prior year. With this information, the workshop computed the fringe benefit percentate rate:

$$\frac{\text{Prior year client fringe benefits}}{\text{Prior year client wages}} \quad \frac{\$9,000}{\$125,000} = 7.2\%$$

This percentage rate (7.2%) was multiplied by the cost for producing 30,000 pieces to arrive at a total direct labor cost:

(30,000 pc.) x (.0816 cost/pc.) x (7.2% fringe benefit) = $2,624.25 or $2,624.00.

Total direct labor cost was then recorded on the contract bid record (page on A2, Direct Labor.

DETERMINING DIRECT MATERIAL AND SUPPLY COSTS

Workshop A would be responsible for the following materials or supplies should their bid be accepted by the company:

(1)	cardboard containers (2' x 2' x 2')	1,200 each
(2)	3-inch box staples	3,600 each
(3)	3-inch gummed, reinforced tape	4,800 feet

The workshop would be responsible for shipping the completed product on pallets. This will not be computed within the bid as some of the pallets will be available from the incoming raw materials and others will be available from other jobs. If a large supply of pallets would be required for the job with none received from the contractor, then the cost of the pallets would have been included within direct material cost.

All direct materials and supplies were computed on a piece price (involving 25 unit pieces). This simplifies the task greatly and avoids having to determine cost for 1/25th of a container. No allowances were added since any amounts left from the job could be used for other jobs throughout the facility. Total direct material cost of $523.00 was recorded under A3 of the contract bid record. Review page 82 for a complete listing of material/supply costs.

Figure 4

JOB: Assembly and Packaging Hardware

DIRECT LABOR COST SHEET

2. Direct Labor Operation	Time Trials #1	#2	#3	#4	#5	Total of Time Studies	Ave. Time	Perf. Rating	Normal Time	%age Allowance	Standard Time	Commen. Hrly Wage	Pieces Per Hour	Cost Per Piece
1	.42	.44	.40			1.26	.42	.93	.392	-	-	$4.50	128	$ .0351
2	.41	.43	.42			1.26	.42	.93	.392	-	-	$4.50	128	$ .0351
3	-	-	-			-	.06	1.00	.06	-	-	$6.50	833	$ .0078
4	.02	.021	.019			.06	.02	.93	.0186	-	-	$4.00	2700	$ .0014
5	.03	.031	.029			.09	.03	.93	.0279	-	-	$4.00	1775	$ .0022

84

TOTAL $ .0816

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Pieces to be produced 30,000 x Cost per piece .0816 x Fringe benefit factor 7.2 % = TOTAL DIRECT LABOR COST $2,624.25

Figure 5

DIRECT MATERIALS/SUPPLIES

Description	Price of Material	Price Per Piece of Material	Amount of Material Required Each Piece	Price Per Piece of Production	Allowances (Losses)	Total Price Per Piece of Production
Cardboard Containers (2'x2'x2')	37\frac{50}{}$/100	$ .375/container	1 container	$ .375	-	$ .375
3-inch box staples	$ 5$\frac{25}{}$/M	$.00525/staple	3 staples	$ .01575	-	$ .01575
3-inch gummed, reinforced tape	$ 4$\frac{50}{}$/400 ft	$.01125/foot	4 feet	$ .045	-	$ .045

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TOTAL $ .43575/container*

Pieces to be produced 1,200 x Cost per piece $ .43575 = TOTAL DIRECT MATERIAL COST $522.90 (or $523)

* Price per container is based on 25 units being in each container.
Therefore, 30,000 units ÷ 25 = 1,200 containers.

DETERMINING FREIGHT CHARGES

Workshop A recorded information pertinent to computing freight charges on their Freight Specification Sheet (page 88). As they would be using their own truck, they calculated vehicle cost per mile. This is as follows:

$$\frac{\text{Total transportation expenses (prior year)}}{\text{Total miles driven (prior year)}} = \frac{\$10,000}{25,000} = \$ .40 \text{ per mile}$$

Since gasoline prices are increasing frequently, Workshop A recomputes transportation costs on a quarterly basis. Estimated freight charges for the job totals $24.00. This is based on sixty miles of truck transportation for the job. Workshop A recorded freight expenses under A4 on the Contract Bid Record.

DETERMINING DIRECT MACHINERY AND EQUIPMENT COSTS

The final area of direct cost which Workshop A needed to compute involved their costs relating to machinery and equipment. The workshop decided that since the plastic wrap packaging machine would be used over a period of five to seven years for the same job (should their bid be accepted), and could be adapted to other packaging jobs, they would then purchase the machine. As such, they calculated cost per piece on the complete life expectancy of the machine. They also decided to purchase the air wrenches required for the job for the same reasons. Descriptions are listed below, and on the Machinery/Equipment Cost Sheet (page 90).

(1) Plastic Wrap Packaging Machine - Cost - $4,500
Life - 1,000,000 pieces

(2) Air Wrenches (13) Cost - $175 each
Life - 750,000 pieces (uses)

An air wrench is described as being used one time if it is in operation for two or more continuous seconds. Thus, an air wrench will complete two uses during the assembly of one unit for each of Steps 1 and 2. (Remember that two nuts and two bolts are assembled during each of Steps 1 and 2.) Therefore, the life expectancy for an air wrench on this particular job will be altered from 750,000 uses to 375,000 units (two uses per unit). Otherwise, the cost per piece will be underestimated.

To determine the amount of cost applicable to the job for the plastic wrap packaging machine, the workshop completed the following steps: (1) they divided the cost of the machine by the life expectancy to arrive at a cost per piece: $4,500 ÷ 1,000,000 = $ .0045 per piece; (2) they divided the number of pieces to be produced for the job by the life expectancy of the machine to arrive at the percentage of life expectancy consumed by the job: 30,000 ÷ 1,000,000 = .03 or 3%; (3) they multiplied cost per piece by pieces to be produced for the job to arrive at the amount of direct machinery cost applicable to the job: $ .0045 x 30,000 = $135.00.

To determine the amount of cost applicable to the job for the thirteen air wrenches, the workshop completed the following steps: (1) they divided the cost of one air wrench by the life expectancy of one air wrench to arrive at a cost per piece: $175 ÷ 375,000 = $ .000467 per unit; (2) they determined the number of units to be completed by one air wrench by dividing the total number of units

to be completed in Step 1 (or Step 2 - they are the same) by 6.5 (the number of air wrenches assigned to Step 1 (and also to Step 2): 30,000 ÷ 6.5 = 4,615.38 units per air wrench; (3) they multiplied the number of units to be completed by one air wrench by the cost per unit to arrive at a direct equipment cost per air wrench: 4,615.38 units x $ .000467 = $2.15; (4) they multiplied the cost per air wrench by thirteen to determine the total direct equipment cost applicable to the job for the air wrenches: $2.15 x 13 = $28.02. They recorded the necessary information on the Machinery/Equipment Cost Sheet (page 90).

Figure 6

FREIGHT SPECIFICATION SHEET

Job: Assembly and Packaging Hardware Date: July 9, 1980

1. Point(s) of Origin for Goods Incoming:
   The EXCEL Company, Inc.
   Warehouse
   121 N. Main Street
   Menomonie, WI 54751
2. Point(s) of Destination for Goods Shipped:
   The EXCEL Company, Inc.
   Warehouse
   121 N. Main Street
   Menomonie, WI 54751
3. Destination of Materials to be Received:
   Workshop A
   1120 Ballentine
   Menomonie, WI 54751
4. Description of Materials to be Shipped:

   Hardware pieces A, B, and C - 30,000 each
   Hex-nuts, bolts, washers - 120,000 each

5. Mode of Transportation:

   Workshop A truck

6. Method of Packing/Shipping:
   (i.e., pallets, boxes/air freight, truck)

   100 containers per pallet - plastic banded
   Shipped via Workshop A's truck

7. Weight and Quantity of Materials:

   Hardware A, B, and C - 90,000 total @ 40,000 pounds
   Nuts, bolts, washers - 360,000 total @ 650 pounds

8. Estimated Freight Charges:
   $ .40 per mile - 6 round trips necessary @ 10 miles per trip
   60 total miles x $ .40/mile = $ 24.00

9. Name and Address of Freight Handlers:

   Workshop A
   1120 Balletine
   Menomonie, WI 54751
10. Time Information Guaranteed for Accuracy:
    60 days

Workshop A then proceeded to complete part 5B of the Machinery/Equipment Cost Sheet. No jigs/toolings were required for the job. They determined that no additional costs were to be included under maintenance, power consumption, storage/handling, and excess scrap/waste. They had no historical data to rely on concerning any frequent repairs which may be necessary for the machine. Since the machine's power supply would be a 220 volt current, they did not anticipate that the machine would use any large amount of power. The job was to be returned to the company within ten days, thus, the workshop had no need to charge any cost for storage/handling. The job was to be a relatively simple assembly and packaging job; thus, they did not foresee any excess scrap or waste. The workshop intended to watch the factors listed above, and if any additional costs would arise from the factors, then the workshop intended to adjust any future bid when the work would have another run. The workshop transferred the total machinery/equipment cost to the Contract Bid Record form.

Having determined the costs which comprise the area Direct Costs, Workshop A then added the costs to arrive at a total cost of $4,339.

Workshop A proceeded to determine their Indirect Costs for the job, based on current information, This amount would be a percentage dollar amount of their direct labor costs for the job. The Indirect Cost Calculation Sheet found on page 91 was used to record the information pertaining to indirect costs. The first area or component that Workshop A needed to determine regarded their indirect labor costs. First, the cost (wages and fringe benefits) of those workers necessary to support the functions of the production department in the workshop was determined. The data was as follows:

Material Handler (2)	$4.00/hr*	80 hrs/pay period	100% time in indirect cost
Janitor (2)	$4.00/hr*	80 hrs/pay period	100% time in indirect cost
Shipping Clerk (1)	$5.00/hr*	80 hrs/pay period	100% time in indirect cost
Truck Driver (1)	$5.50/hr*	80 hrs/pay period	100% time in indirect cost
Truck Helper (1)	$4.00/hr*	80 hrs/pay period	100% time in indirect cost

* includes wage plus fringe benefits

Within the area of direct costs, freight expense pertained to the vehicle costs themselves and did not include any costs for the truck driver or helper. Therefore, their costs have been included within the area of indirect labor cost.

Workshop A, with the above information, received from their bookkeeper, recorded the necessary data on the Indirect Cost Calculation Sheet (page 90).

Next, Workshop A proceeded to determine their indirect materials cost. For this information, they had their bookkeeper review the purchase records. They determined that indirect materials cost for the prior six month period totaled $1,900. Workshop A felt that a 10% allowance would be an appropriate amount to cover scrap, losses, or expenses of procuring the materials. Thus, the adjusted indirect materials cost totaled $2,090.

The third component of indirect costs which the workshop concerned themselves with pertained to costs of supervision. These costs included the wages and fringe benefits of their employees whose jobs involved the supervision of workers performing direct or indirect labor functions within the production unit.

Figure 7

5A. Machinery/Equipment

Description	Life Expectancy (Pieces)	Cost of Equipment & Machinery	Pieces to be produced for job	Percentage of Life Expectancy	Cost Per Piece	Direct Equipment and Machinery Cost
1. Plastic Wrap Packaging Machine	1,000,000	$4,500	30,000	3%	$ .0045	$135
2. Air Wrench	375,000	$ 175	4,615.38	1.23%	$ .000467	$ 28.02 ($2.15 per wrench)
3.						
4.						
5.						
6.					TOTAL	$163.02

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5B. Related Machinery/Equipment Costs

	Description	Cost
Jigs/ Toolings	1.	-
	2.	-
	3.	-
	4.	-
	Total Jig/Tooling Cost	-
Maintenance		-
Power Consumption		-
Storage/Handling		-
Excess Scrap/Waste		-
TOTAL COSTS		-

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(1) TOTAL DIRECT MACHINERY/EQUIPMENT COST $163.02

(2) TOTAL DIRECT RELATED MACHINERY/EQUIPMENT COST

(2) TOTAL MACHINERY/EQUIPMENT COST $163.02

Figure 8

INDIRECT COST CALCULATION SHEET

1. CURRENT INFORMATION	1 No. Employees	2 Total Salaries/Benefit Per Pay Period	3 Total Manhours Per Pay Period	4 Hrs/Pay Period in Indirect Cost Area	5 Percent of #4 to #3	6 Total Salaries #2 x #5
Indirect Labor	7	$2,440	560	560	100%	$2,440
Supervision	8	$2,800	640	560	89%	$2,492
Administration	4	$2,396^{15}	320	320	100%	$2,396^{15}

TOTAL SALARIES APPLICABLE PER PAY PERIOD $7,328.15

Total Salaries Applicable Per Pay Period	$7,328^{15}
Indirect Materials/Supply Purchases/Usage	2,090
Indirect Equipment Costs	3,500
Maintenance and Repair Costs	450

Period of Current Information January - June, 1980

2. TOTAL ADJUSTED INDIRECT EXPENSES FROM PRIOR YEAR (79)	$200,000
3. TOTAL DIRECT LABOR EXPENSE FROM PRIOR YEAR (79-80)	140,000
4. INDIRECT COST (2 ÷ 3)	1.43
5. INDIRECT COST AS A PERCENTAGE (4 x 100)	143 %

Workshop A employed eight production supervisors, six of whom worked full-time for the production unit. The remaining two supervisors worked 50% of the time in the production unit and 50% of the time for the rehabilitation department. Each of the eight supervisors worked 80 hours per pay period. Salaries and fringe benefits for the eight supervisors, for an 80 hour pay period, totaled $2,800. With this information, the workshop was able to record the necessary data on the Indirect Cost Calculation Sheet (page 91). Man-hours per pay period for the eight supervisors totaled 640 hours. However, only 560 hours per pay period were within the production unit. The remaining 80 hours were within the rehabilitation unit (two supervisors @ 50% time in rehabilitation).

Workshop A then proceded to determine their administrative costs as they pertained to the production unit. These costs involved the salaries and fringe benefits of administrator's functioning within the production unit and other administrative expenses necessary to maintain the production unit. They determined the following:

One contract procurement person @ $21,500
One bookkeeper (sales and production expenses) @ $10,500
One production manager @ $15,800
One industrial engineer @ $14,500

Each of the above individuals was employed full-time (80 hour/pay period) within the production unit. With this information, Workshop A recorded the necessary data on the Indirect Cost Calculation Sheet (page 91).

Having recorded the data for indirect labor, supervision, and administration, the workshop added the salaries to arrive at a total salary cost applicable per pay period ($2,440.00 + $2,492.00 + $2,396.15 = $7,328.15).

Workshop A then determined current data on indirect equipment costs and maintenance and repair costs. Costs within the area of indirect equipment cost included: forklift (one), storage shelves for work supplies, staplers, sealing tape machines, worktables and chairs, and other miscellaneous items used in the production area exclusively, and on a number of jobs. Records from the facility bookkeeper placed such costs at a figure of $3,500 for the current period (which was for the past six month period). This amount was recorded on the Indirect Cost Calculation Sheet (page 91) in the column entitled Indirect Equipment Costs.

The repair costs associated with the facility truck were not included in the maintenance and repair cost area since such costs were determined earlier as a direct cost (under freight expenses). Maintenance and repair of production equipment was considered as an indirect expense. Again, from bookkeeping records, an amount of $450 was obtained for maintenance and repair of equipment, etc., located throughout the facility.

With the assistance of the workshop's accountant, the current indirect costs were compared with similar data from the previous fiscal year. In their opinion, the current data and costs were within line with the previous year's data. If certain costs had changed dramatically, it would have been noted, with changes made upward or downward regarding indirect costs.

The facility accountant determined that indirect costs for fiscal year 1979 totaled $200,000. Since the financial information for the six month period January-June, 1980 was reasonably close to the prior year's financial data, the $200,000 was recorded on #2 of the Indirect Cost Calculation Sheet.

The facility accountant then examined total direct labor cost for fiscal year 1979. This cost was $125,000. However, minimum wage increased $ .20 per hour on January 1, 1980. Also, the client population within the facility is proposed to increase by 10% during 1980. Thus, the facility accountant projected 1980 direct labor costs to increase to $140,000. Therefore, the workshop recorded $140,000 on line three (total direct labor expenses from prior year) of the Indirect Cost Calculation Sheet.

With #2 and #3 costs recorded, Indirect Cost (#4) was computed ($200,000 ÷ $140,000 = 1.43). Expressed as a percentage, Indirect Cost is 143% of direct labor cost for any job which the workshop may complete. The workshop recorded 143% on #1 of B. Indirect Costs (on the Contract Bid Record). Since direct labor cost for the job was calculated to be $2,624, then total indirect cost for the job becomes $3,752 ($2,624 x 143% = $3,752).

Workshop A then determined the percentage factor which would be used to compute overhead for all jobs.

The procedure that Workshop A used to determine overhead costs was similar to that used for determining their indirect costs. The accountant made a comparison between overhead costs data from the previous fiscal year and current cost information. Workshop A decided to estimate the percentage of each individual's time which was spent dealing with or performing duties connected with the production unit. The remaining overhead costs would be allocated on a "square footage" basis.

The accountant provided the necessary financial information concerning the salaries and wages (including fringe benefits) of those employees who spent time dealing with or performing duties connected with the production unit. The accountant provided the following annual salaries (including fringe benefits) of each employee and the percentage of time spent with the production unit:

Executive Director	$26,800	10%
Accountant	$18,500	40%
Personnel Manager	$17,600	30%
Purchasing and Payroll (2)	$21,400	25% each
General Secretaries (2)	$17,400	35% each

This information was recorded within #1 - Salaries and Wages, of the Overhead Cost Calculation Sheet (page 95).

Next, the accountant obtained financial data on the remaining costs associated with overhead. These costs would be allocated on the "square footage" basis. The production unit occupied 10,000 square feet of the 15,000 square foot workshop. Thus, 66.66% of the facility was devoted to production. The overhead costs, #2 on page 95, were determined with the assistance of the accountant. The amounts which the accountant arrived at were recorded in the appropriate places on #2. The amount of other costs applicable to overhead (#2) was determined by multiplying the total costs for #2 by the percentage figure of the workshop devoted to production (66.66%). The amount arrived at was $25,864.00 ($38,800 x 66.66% = $25,864.00). Total salaries, wages, and other costs totaled $70,064 ($44,200 +

$25,864). Direct labor cost for the same time period as #1 and #2 was recorded on #3 ($140,000). Total annual overhead cost (#4) was determined by dividing #2 by #3 ($80,064 ÷ $140,000 = .50). Overhead cost as a percentage, then, equals 50%. This percentage amount was recorded on part C of the Contract Bid Record. When multiplied by the total direct labor cost for the assembly and packaging hardware job ($2,624), a total overhead cost of $1,312 is arrived at for the job.

Figure 5

OVERHEAD COST CALCULATION SHEET

1. SALARIES & WAGES

Person/Position	Annual Salary (incl. benefits)	% Time Charged to Production Overhead	Annual Salary Applicable to Overhead
Executive Director	$26,800	10%	$ 2,680
Accountant	18,500	40%	7,400
Personnel Manager	17,600	30%	5,280
Purchasing & Payroll (2)	21,400	25%	5,350
General Secretaries (2)	17,400	35%	6,090
		TOTAL	$44,200

$44,200

2. OTHER COSTS

Building		$18,000
Utilities		9,000
Insurance		3,800
Supplies		3,000
Office Equipment		1,500
General Workshop Furnishings and Equipment		2,000
Other Related Costs		1,500
Total Costs		$38,800

(1) Total Square Feet of Facility 15,000

(2) Total Square Feet of Production Area 10,000

(3) Percentage of Facility Devoted to Production (2) ÷ (1) 66 2/3%

Amount of Other Costs Applicable to Overhead (Total Costs x Percentage of Facility Devoted to Production) $25,864

TOTAL SALARIES, WAGES, AND OTHER COSTS $70,064

3. DIRECT LABOR COST (same time period as #1 & #2) $140,000

4. TOTAL ANNUAL OVERHEAD COST (#2 ÷ #3) .50

5. OVERHEAD COST AS A PERCENTAGE (#4 x 100) 50 %

The final area that Workshop A needed to resolve pertained to the percentage amount of profit to be applied to the costs of the assembly and packaging hardware job. From historical financial data, and taking into consideration the size of the job and the future runs expected, Workshop A settled on a 15% profit factor. Total profit for the job equaled $1,410 (Total Costs of $9,403 x 15% profit factor = $1,410) and was recorded on the Contract Bid Record. Should the workshop need to negotiate a bid price with the business, under no circumstances should they settle on an amount more that $1,410. Otherwise, they would not be meeting their costs for completing the job.

Finally, Workshop A determined the bid price which they would submit to the business. They added direct cost, indirect cost, overhead, and profit to arrive at $10,813. This dollar amount could then be quoted to the business for the job; or, the workshop could quote a piece-rate figure by dividing $10,813 by 30,000 pieces ($10,813 ÷ 30,000 pieces = $ .36 per piece).

Workshop A then placed all of the forms used to determine the bid price for the assembly and packaging hardware job into their files for future reference. The percentage amounts which they determined for their indirect costs and for overhead would be used for all future jobs bid on for at least the next six months, and possibly twelve months. Thus, future jobs will entail determining direct costs and profit factor only.

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